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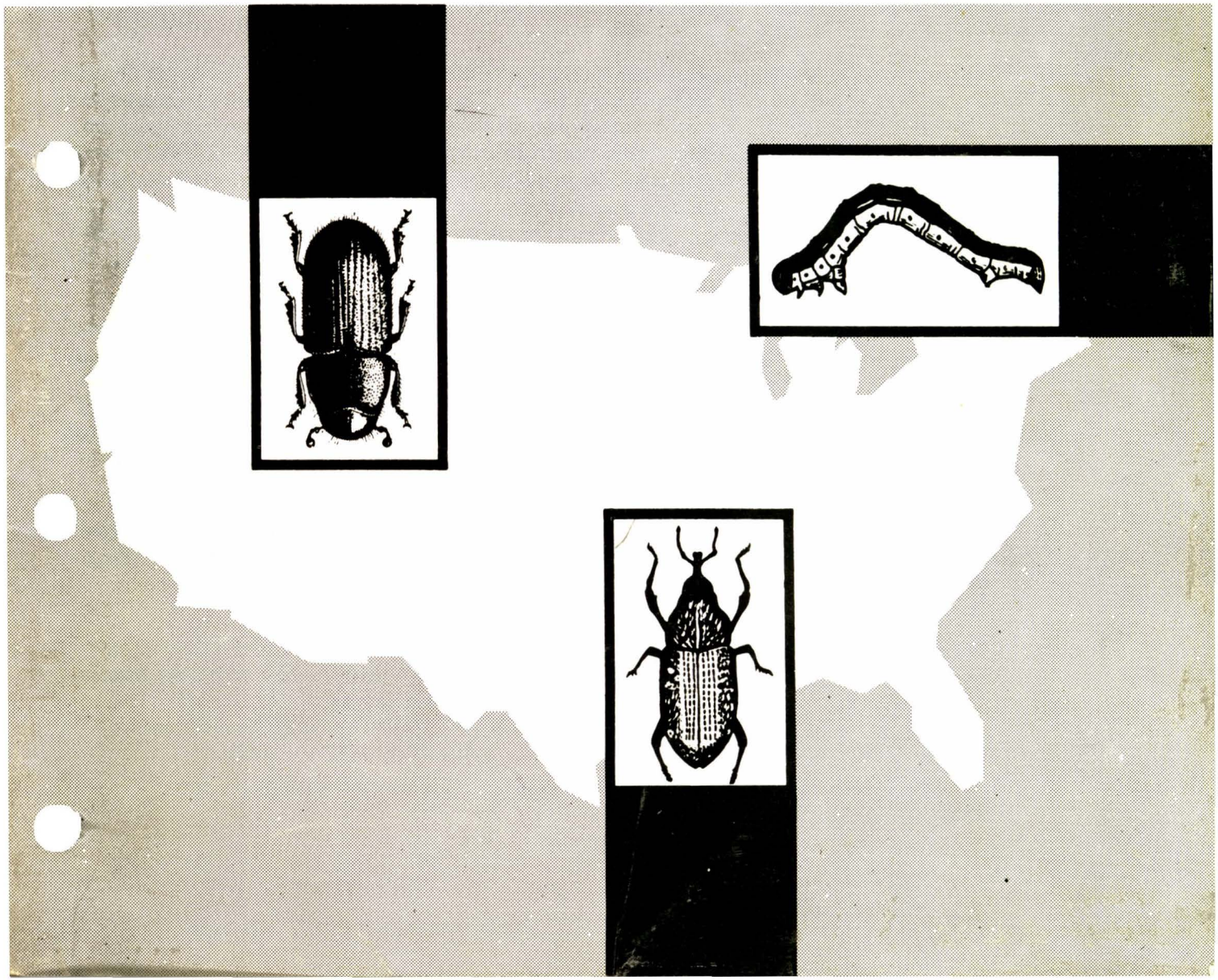
ISECT CONDITIONS IN THE UNITED STATES - 1965

ATES DEPARTMENT OF AGRICULTURE • FOREST SERVICE



Foreword

This summary report on the status of the more important forest insects in the United States is primarily for the information of persons interested in protecting our forest resources against damage and loss that insects cause. It serves also as a ready reference to other persons interested in the fluctuations of pest populations, the periodicity and locations of outbreaks, and in the scope of cooperative work among Federal, State, and private agencies in survey operations and in action programs for suppression. The format of the report reflects efforts to satisfy this diversified audience. The following section highlights the more important conditions nationally. Each of the ten sections which describe the status of insects by forest regions is prefaced by a brief regional summary.

Issuance of the report in 1965 on "Restoring the Quality of Our Environment" by the President's Science Advisory Committee again called attention to need for great care in the use of pesticidal chemicals for control of insects in order to avoid or minimize contamination. Although the Committee's report recommended action on all forms of pollution, it emphasized the need to avoid heavy dependence on persistent pesticides which pose residue problems in man and animals. The Forest Service and cooperating agencies are following the policy of not using persistent pesticides in action programs to control forest insects in all cases where research and field tests have demonstrated that a commercially available nonpersistent chemical or non-chemical methods will accomplish a control job effectively and safely.

A comprehensive investigation of nonpersistent pesticides suitable for suppressing forest defoliators was begun in 1964 at the Forest Service Experiment Station, Berkley, California. This led in 1965 to field tests of a carbamate insecticide to control the spruce budworm, which produced gratifying results. This pesticide will be pilot tested in 1966. The investigative unit also made excellent progress during the year to further improve aerial spraying to control forest defoliators. A major step was the use of fluorescent particles in spray solutions to track spray deposits. Significant progress was also made in stabilizing pyrethrins; if this can be fully achieved, it should not only lead to further improvements in defoliator control, but also to less dependence on persistent pesticides.

Mention of commercial products and named insecticides in this report does not imply endorsement by the U. S. Department of Agriculture, Forest Service. The Forest Service also warns that pesticides if improperly used can be injurious to humans, fish, and wildlife; that the directions and precautions governing their use should be closely followed; and that overdosing is dangerous and should be avoided. Special care should be taken in applying pesticides along the edges of rivers and streams, around ponds and lakes, and in grazing and foraging areas.

Grateful acknowledgement is made to all those Federal, State, county and private agencies whose assistance and cooperation made this report possible. Comments on the report are welcome.

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Surveys and Control of Forest Insects
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Highlights

With the exception of virulent epidemics of bark beetles in stands of lodgepole pine in portions of Idaho, Wyoming, and Utah, damage and loss caused by forest insects in the United States in 1965 were well below levels of the past few years. There were, of course, many new outbreaks of bark beetles, defoliators, and other pests at various locations in all sections of the country. However, other than the lodgepole epidemics, most were checked by timely suppressive action before they caused intolerable damage. The most troublesome problems across the country, and an accounting of action programs undertaken to suppress them, are outlined in the following paragraphs.

Conditions in the Pacific Coast States

Forest insect conditions in Alaska improved considerably over 1964. In the Southeastern panhandle, the black-headed budworm largely succumbed to natural control factors and major defoliation occurred only from Haines and Skagway inland to the Canadian border. Hemlock sawfly populations also were well below 1964 levels and infestations were concentrated largely on Prince of Wales and Chichagof Islands. Bark beetle infestations were low.

In Oregon and Washington, outbreaks of destructive insects were confined to about 1.4 million acres. The bulk of damage to the forest resource was again caused by bark beetles. While the gross area of infestations by defoliating insects increased slightly from 1964, that affected by sucking insects decreased. Known infestations of the European pine shoot moth outside the containment zone in western Washington are believed to have been eradicated. Also, the serious outbreaks of Douglas-fir tussock moth in eastern Oregon were successfully controlled by aerial spraying.

In California two new defoliating species appeared which were never before seen there in damaging numbers. One, a needle miner, damaged red fir in the central Sierra Nevadas. The other, a looper, attacked Douglas-fir at four locations near McCloud. Bark beetle activity centered primarily in stands of Douglas-fir and ponderosa pine that were downed and damaged by the severe winter storm of 1964–65. However, an increased volume of Jeffrey, lodgepole, ponderosa, and sugar pines also was killed by beetles elsewhere. Aerial spraying, aided by natural control factors, ended the severe outbreak of Douglas-fir tussock moth.

Conditions in the Intermountain, Rocky Mountain, and Southwestern States

The population explosion of the mountain pine beetle in stands of lodgepole pine in southern Idaho and western Wyoming dominated all insect problems in the Intermountain, Rocky Mountain, and Southwestern States. The most extensive and spectacular of these infestations was on the Teton and Targhee National Forests, and Grand Teton National Park, where beetles killed upwards of two million trees. Less spectacular, but serious infestations in lodgepole pine occurred elsewhere in Idaho and Wyoming, and at several locations in Utah. The mountain pine beetle was also quite destructive in several stands of white pine and ponderosa pine in Idaho and Montana. Infestations in north Idaho killed several million board feet of mature white pine. A heavy toll was taken of young ponderosa pines in Montana.

The long-standing outbreaks of the spruce budworm continued unabated in Montana, and damage to host trees was moderate to severe on about 2–1/4 million acres. The larch casebearer continued its spread through the 2.5 million acres of western larch in north

Idaho and Montana and caused heavy defoliation in all affected stands. Other pests of larch, such as the larch sawfly, looper, and budmoth added to damage of stands in both States.

The major outbreak of the Douglas-fir tussock moth in Latah and Benewah Counties, Idaho was brought under control by aerial spraying and a naturally occurring polyhedral virus. Another tussock moth, however, was recorded for the first time in stands of ponderosa pine around Ashland and Ft. Howes, eastern Montana.

Several other major infestations persisted or developed anew in the Intermountain States. For example, spruce budworm populations continued at a high level on some 2.3 million acres of host type in Idaho; practically all of the lodgepole pine stands in southern Idaho and Western Montana suffered varying degrees of defoliation by a lepidopterous complex; and, defoliation of pinyon pine by a sawfly was widespread in western Nevada.

Forest insect infestations throughout most of the Central Rocky Mountains were down to their lowest level since the early 1950's. The serious outbreaks of Black Hills beetles in South Dakota were checked and infestations at scattered locations in Colorado and Wyoming also were contained. Blowdown spruce at several locations in southern Colorado portends serious outbreaks of Englemann spruce beetles, but prompt salvage of the down timber may avert damaging infestations. Spruce budworm populations in Colorado remained high only on about 80,000 acres.

Defoliators were the most important forest insects in the Southwestern States. The white fir needle miner, a newcomer there, heavily defoliated white fir on some 62,000 acres in northern Arizona. Two tussock moths, also previously unobserved in the two States, became important when the larvae stripped broadleaf trees in high-use recreation areas in southern New Mexico. The spruce budworm, long the Number 1 enemy of Southwestern forests, damaged mixed conifer stands on about 470,000 acres. Of these, 50,000 acres were heavily defoliated in a new outbreak near Taos, New Mexico. The virulence of this new outbreak is such that plans were made to suppress it by aerial spraying early in June. Control of forest insects in Arizona and New Mexico in 1965 was confined largely to aerial spraying of the Great Basin tent caterpillar infestations, and logging or hand spraying trees infested by bark beetles.

Conditions in the South and Southeast

Conditions of forest insects in the South and Southeast were little changed from those of 1964. The southern pine beetle continued or developed anew in outbreak numbers at many locations, especially in north central North Carolina, South Carolina, Tennessee, Alabama, Mississippi, Louisiana, and Texas. The black turpentine beetle and ips beetles also caused considerable damage at many locations and, in the aggregate, killed as many or more trees than the southern pine beetle.

The balsam wooly aphid killed many fir trees in North Carolina, and infestations spread to new locations, including the Tennessee side of Roan Mountain. Pales and associated weevils were highly destructive to pine seedlings in stand clearings in coastal areas of North Carolina. Several species of insects also caused heavy losses to pine seeds and cones in almost all seed production areas and seed orchards.

Conditions in Lake States, Central States, and the Northeast

The major forest insect problem in the Lake States was an increase of defoliator activity. Infestations of the Jack pine budworm extended from Lower Michigan to central and north central Minnesota; the forest tent caterpillar became firmly entrenched in hardwood stands along the northern border of Minnesota and in the northern tier of counties in Upper Michigan; and red-headed pine sawfly populations caused severe damage to red pine plantations at many locations.

In the Central States, living tree borers of hardwoods remained the primary problem. In addition, the fall webworm and various pine defoliators and tip and shoot insects caused concern in local areas.

Defoliators of hardwoods were the most important forest insects in the Northeast, with the fall cankerworm the most serious offender. In northeastern Pennsylvania and northern New Jersey, the cankerworm stripped much of the foliage from host trees on more than 750,000 acres. The oak leaf tier and associated species also severely defoliated large acreages of oak stands in Connecticut, New Jersey, and Pennsylvania. Other defoliators, such as the gypsy moth, forest tent caterpillar, pine sawflies, hemlock and pine loopers, and others were troublesome in local areas. The balsam woolly aphid, white pine weevil, and red pine scale continued as chronic problems in many locations.

Suppression Activities

Concerted efforts by Federal and State agencies and owners and managers of forest lands were continued during 1965 to check the damage and losses caused by insects. The largest control project was against the mountain pine beetle in lodgepole pine in southern Idaho and western Wyoming, where more than 500,000 infested trees were sprayed, burned, or logged. Although control of infestations was largely achieved on the Teton National Forest and Grand Teton National Park, additional large-scale effort will be needed in 1966 to contain the epidemic on the Targhee National Forest. The outbreaks of Black Hills beetle in the Black Hills of South Dakota and Wyoming, and at several locations elsewhere in Wyoming and Colorado were reduced to endemic levels.

Southern pine beetle infestations in most areas of the South and Southeast were reduced to low levels during the spring and summer months, but outbreaks which recurred or developed anew at many locations later in the year triggered resumption of control action on a major scale. Persistent infestations of the black turpentine beetle required a continuation of suppression work to reduce the rate of tree killing in problem areas. Small-scale tests for the control of pales and associated weevils, and cone and seed insects were only partially successful.

Aerial spraying of 105,000 acres to control the fall cankerworm in Pennsylvania was the major effort against pest species in the Northeast. However, outbreaks of the hemlock looper in Maine and New Hampshire also required suppressive measures to prevent mortality of its host trees.

A summary of pest control operations for 1965 is presented in the following tabulation:

Projects	*Location*	*Trees Treated*	*Acres Sprayed*
Mountain pine bettle	Utah, Idaho, Wyo.	515,000	--
Black Hills beetle	S. D., Colo., Wyo.	112,000	--
Southern pine bettle	South & Southeast	283,000	--
Black turpentine beetle		[1]508,000	--
Western pine beetle	California	12,000	--
Spruce budworm	Idaho, Mont.	------	16,000
Fall cankerworm	Pennsylvania	------	105,000
Douglas-fir tussock moth	Cal., Ore., Idaho	------	241,000
Tent caterpillar	Minn., Ariz.	------	22,000
Miscellaneous insects	Countrywide	75,000	30,000
Total		1,505,000	414,000

[1] Includes treating of stumps

Forest Insect Conditions in the Various Regions

OREGON AND WASHINGTON

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Conditions in Brief

Outbreaks of destructive insects occurred on 1.4 million acres in Oregon and Washington. Infestations of defoliators increased, outbreaks of bark beetles remained static, while damage by sucking insects decreased. The bulk of damage was caused by bark beetles.

Known infestations of the European pine shoot moth outside the containment zone in western Washington are believed to have been eradicated. In Oregon, one shipment of infested pines was intercepted and destroyed.

No large-scale chemical control projects are planned for 1966.

Status of Insects

Larch casebearer, *Coleophora laricella* (Hbn.). Outbreaks increased in size and intensity in northeastern Washington. Most of the defoliation occurred in stands of western larch on the Kaniksu and Colville National Forests and on the Northeast Washington District administered by Washington State Department of Natural Resources. The insect has moved westward steadily for the last few years and is now established west of the Columbia River on the Colville Indian Reservation. The trend of the infestation is upward, but no trees have been killed yet. No control is necessary in 1966.

Larch sawfly. *Pristiphora erichsonii* (Htg.). New infestations of this insect developed on the Warm Springs Indian Reservation in Oregon and on the Yakima Indian Reservation in Washington. Older infestations on the Mount Hood National Forest in Oregon increased in extent and intensity. Subepidemic populations of the larch sawfly can be found in almost any larch stand along the Candian border in Washington.

Parasitism by a wasp, *Tritneptis* sp., was heavy in all infestations. Various small mammals took a heavy toll of new cocoons. Despite predation and parasitism, larval feeding is expected to continue at about the same rate on the Yakima and Warm Springs Indian Reservations. Less defoliation is expected on the Mount Hood National Forest in 1966.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Larval populations at the major infestation centers on about 70,000 acres on the Malheur and Ochoco National Forests in Oregon were successfully controlled by aerial spraying. Insect mortality exceeded 98 percent.

Most older outbreaks in northeastern Washington decreased in size and severity; some subsided completely. New infestation centers developed in Oregon on the Fremont National Forest west of Lakeview, on the Hart Mountain Antelope Refuge east of Lakeview, and on Bureau of Land Management lands northeast of Malin. The new areas are small and few new egg masses have been found. Hence, control will be unnecessary in 1966.

Western oak looper, *Lambdina fiscellaria somniaria* (Hulst). Infestations declined in the Willamette Valley of Oregon. Defoliation ranging from light to heavy continued at a few older centers near Dallas, Sheridan, and Willamina, Oreg. No control is necessary in 1966. Larval feeding on individual ornamental trees can be controlled by spraying with DDT or other insecticides.

Western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hulst). No outbreaks of the western hemlock looper were found in Oregon or Washington coastal forests in 1965.

Pine needle miners, *Recurvaria* spp. Light damage to small areas of ponderosa pine occured near Wocus Bay on the Winema National Forest, Oreg. Lodgepole pine suffered light defoliation near Chemult, Oreg. on the Winema Forest, and on the Deschutes Na-

[1] Based on cooperative surveys with Oregon State Department of Forestry and Washington State Department of Natural Resources.

F–513678

Helicopters were used exclusively in suppressing Douglas-fir tussock moth infestations in Oregon.

tional Forest near Wickiup Reservoir. No control is needed in 1966.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). Known infestations are confined to 15 species of pine used as ornamentals and for Christmas trees. Mugho and Scots pine are the preferred hosts in the Northwest.

In Washington, 88 communities outside the containment zone were surveyed by Washington State Department of Natural Resources personnel. Infested trees were found in two Christmas tree plantations, one nursery outplanting site, and four residences near Olympia, Wash. All pines at the nursery outplanting were destroyed by the owner. It was later determined that infested trees had been shipped to Klickitat and Kettle Falls in eastern Washington. Fortunately, the trees were intercepted and destroyed before moth flight.

In Oregon, no infestations were found during eradication surveys in residential areas of Portland and Salem. However, three trees in

a newly planted roadside landscaping along the Minnesota Freeway in North Portland were found to be infested. The source of infested stock was traced to the infested nursery outplanting site near Olympia, Wash. All pines of unknown origin in the planting were destroyed prior to moth flight.

Interception of these infested trees illustrates plainly the ease with which the shoot moth could be transported to valuable pine stands in eastern Oregon and Washington. Research is underway to develop eradication methods. In the meantime, continued spread within the containment zone can be expected.

Strict adherence to State and Federal quarantines and use of prescribed fumigation techniques of nursery stock will slow spread of the shoot moth. Diazinon or Sevin insecticides sprayed on individual infested ornamental pines will reduce the larval population, but will not eradicate it.

Balsam woolly aphid, *Chermes piceae* (Ratz.). Outbreaks in Oregon and Washington true fir stands decreased significantly. Most of the damage was on the Gifford Pinchot and Snoqualmie National Forests in Washington and on the Mount Hood, Willamette, Umpqua, Deschutes, and Rogue River National Forests and Crater Lake National Park in Oregon. Salvage of infested-merchantable trees and those in declining thrift is recommended to save timber values.

Spruce aphid, *Neomyzaphis abietina* (Wlkr.). Light defoliation of Sitka spruce occurred on the Olympic National Forest and Olympic National Park in Washington. Outbreaks of this insect generally subside without causing any lasting damage to the stand. No control is planned for 1966.

Pine needle scale, *Phenacaspis pinifoliae* (Fitch). Moderate and some heavy defoliation occurred on lodgepole pines near Wickiup Reservoir on the Deschutes Forest. The damage is not severe enough to require control in 1966.

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.). (*D. monticolae* Hopk.) By far the largest acreage infested by the beetle occurred in western white pine stands along the Cascade Mountains in Oregon and Washington. Significant tree killing occurred on and near the Willamette, Mount Hood, and Umpqua National Forests in Oregon, and on the Gifford Pinchot, Olympic, Snoqualmie, and Wenatchee National Forests and Olympic National Park in Washington.

Tree mortality in young ponderosa pine stands increased sharply in both States. Major losses in Washington occurred on and near the Okanogan, Umatilla, and Colville National Forests, and on the Yakima and Colville Indian Reservations. Dense pole and sapling stands on the Wallowa-Whitman, Umatilla, Malheur, Winema, and Fremont National Forests sustained the bulk of the losses in Oregon. In some areas, more than half of the stems were killed. This problem will become more acute in the future as stocking becomes more dense on cutover areas.

Outbreaks in lodgepole pine stands increased in Oregon forests, but decreased in Washington forests. The majority of the infested acreage was on or near the Fremont, Winema, and Deschutes Forests in Oregon.

Heaviest losses in sugar pine stands occured on some 6,000 acres mostly on or near the Siskiyou National Forest in southern Oregon. Most of these losses occurred as single trees and in small groups in mixed coniferous stands.

Attacks reached light to moderate epidemic status in knobcone pine stands on the Umpqua Forest in Southern Oregon. Defoliation by sawflies from 1962 to 1964 may have predisposed the trees in this area to attack by the beetles.

Direct control of the mountain pine beetle in white pine stands is impractical in Oregon and Washington. Salvage of merchantable-infested and intermingled green pines is encouraged to reduce beetle populations and save timber values in problem areas. Thinning stagnated ponderosa pine will improve tree vigor and reduce susceptibility to insect attack. Other than routine salvage of merchantable infested trees, no control is needed.

Western pine beetle, *Dendroctonus brevicomis* LeC. Western pine beetle outbreaks covered about the same area as last year but were less severe. The most losses were cen-

F-513658

True firs on the Malheur National Forest, Oregon, were severely defoliated by the Douglas-fir tussock moth before the epidemic was suppressed in 1965.

tered on the Malheur, Ochoco, Fremont, Umatilla, and Winema Forests in Oregon and on the Colville and Yakima Indian Reservations, and the Snoqualmie, Okanogan, and Wenatchee Forests in Washington. The trend of damage is expected to be static to downward with some localized mortality. Sanitation-salvage logging to reduce beetle-caused losses in high-risk stands is underway or planned in most problem areas.

Fir engraver, *Scolytus ventralis* LeC. Infestations decreased in Oregon forests and increased in Washington. Most of the tree killing occurred on the Fremont, Wallowa-Whitman, Umatilla, and Ochoco Forests in Oregon and on the Colville, Okanogan, and Wenatchee Forests in Washington. Damage trend is expected to be static to downward. No control is needed in 1966.

Oregon pine ips, *Ips pini* (Say). (*I. oregonis* (Eichh.).) Tree killing in ponderosa pine sapling and small pole stands increased in Oregon and Washington, but remained well below the heavy losses experienced a few

years ago. The largest infestations occurred on dry sites on the Malheur and Winema Forests in Oregon, and on the Okanogan and Wenatchee Forests in Washington. Outbreaks of this beetle will likely increase regionwide. Good management practices generally preclude the need for direct control.

Engelmann spruce beetle, *Dendroctonus* obesus (Mann.). (*D. engelmanni* Hopk.). Infestations increased from the all time low experienced last year, but remain well below the critical level. Most outbreaks occurred in Oregon on the Wallowa-Whitman and the Umatilla Forests. The remaining losses were centered on the Wenatchee and Okanogan Forests in Washington. A slight upward trend is expected in 1966, but no control is necessary. Salvage of infested trees is recommended.

Silver fir beetles, *Pseudohylesinus* spp. Tree killing by *P. grandis* Sw. and *P. granulatus* (LeC.) in combination with the root rot fungus *Armillaria* sp., increased on the Mount Baker and Snoqualmie National Forests in Washington. Subepidemic tree mortality was fairly common in most northwestern Washington forests. No epidemic tree mortality occurred in the Oregon Coast Range. Logging infested-merchantable trees and those of declining thrift in problem centers is recommended to reduce beetle populations and save timber values.

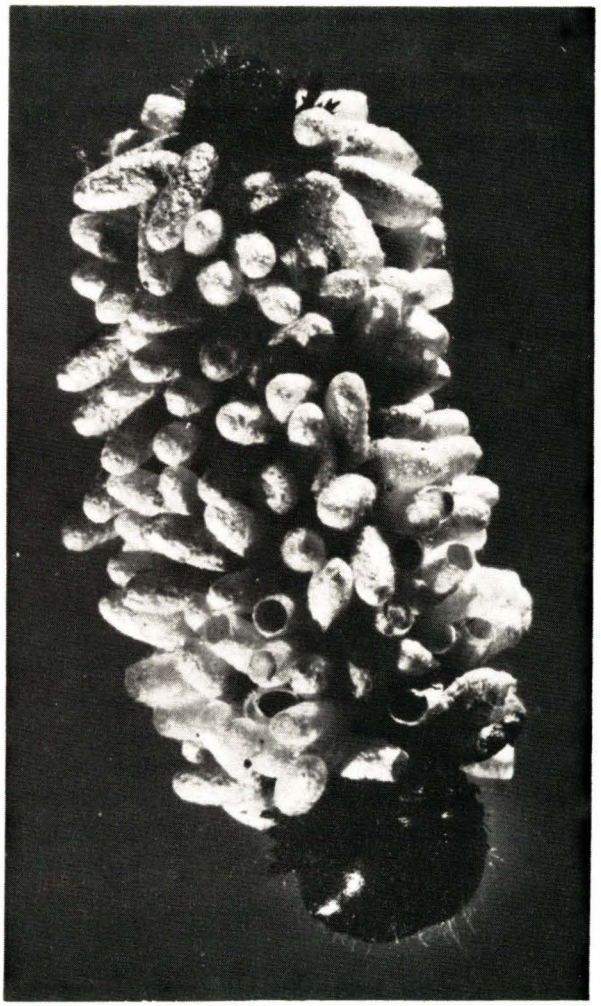
Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Moderate to severe Douglas-fir beetle outbreaks developed in the southern Oregon Coast Range extending from the Mary's River southward to the Rogue River, and eastward to the Willamette Valley. South of the Rogue River to the California line, scattered small groups and single trees were fairly common. Douglas-fir beetle losses also increased in the southern Oregon Cascades. Most of the redtopped trees were attacked in 1964, but about half did not fade until 1965. The ratio of 1965 attacks to 1964 attacks was generally lower.

Light to moderate losses in eastern Oregon were centered on the drier sites on and near the Wallowa-Whitman Forest.

In Washington, outbreaks increased. Tree mortality was centered on and near the Snoqualmie and Gifford Pinchot Forests in western Washington. In eastern Washington, damage occurred on the Colville Indian Reservation and on or near the Okanogan and Colville Forests.

Losses are expected to decline in the Oregon Coast Range. An increase is expected in the southern Oregon Cascades. Tree mortality is likely to increase slightly in western Washington.

Stepped-up salvage of infested trees and



F–513768

Infestations of pandora moth often are brought under control by heavy parasitism of the larvae, shown here covered by parasite cocoons. Ochoco National Forest, Oregon.

nearby current windthrow is recommended in both States to reduce beetle populations and save timber.

Other insects. The phantom hemlock looper, *Nepytia phantasmaria* (Strecker), continued to cause light to moderate defoliation of ornamental Douglas-firs in Portland, Oreg., suburbs.

An "off-year" flight of the pandora moth, *Coloradia pandora* Blake, occurred on the Winema Forest near Chemult, Oreg. Parasitism was common on mature larvae just before pupation.

Sawfly larvae, *Diprion* and *Neodiprion* spp., were numerous, but well below the critical level on most conifers.

The black-headed budworm, *Acleris variana* (Fern.), caused some light defoliation of true firs and Douglas-fir on the Malheur National Forest in Oregon. More damage is expected in 1966.

CALIFORNIA

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Conditions in Brief

Aerial spraying with DDT, aided by natural factors, particularly a virus disease, brought under control the worst outbreak of the Douglas-fir tussock moth ever recorded in California.

Two new defoliating insects, never before known to have occurred in damaging numbers in California, were reported in 1965. One, a needle miner attacking red fir, was active and damaging in parts of the Sierra National Forest and Yosemite National Park; the other, a phantom hemlock looper, defoliated pole-sized Douglas-fir in four limited-scale infestation centers south of McCloud.

For the third year the white-fir sawfly continued to be active in central and northern California. This sawfly and the Douglas-fir gall midge again damaged high-value Christmas tree plantations in the central and northern parts of the State.

Bark beetle activity increased from the low population levels of 1964. Extensive surveys in the north coast area indicated that the Douglas-fir beetle infested all of the concentrations of down or damaged Douglas-fir that resulted from the storms of 1964–65. Western pine beetle populations increased in ponderosa pine along streams which flooded that winter.

An increased volume of Jeffrey pine was killed by the Jeffrey pine beetle in widely separated regions. The mountain pine beetle killed many lodgepole pines and caused some damage to ponderosa and sugar pines. The California flatheaded borer killed Jeffrey pines locally in southern California. Damage by the fir engraver and ips remained low in 1965.

A variety of insects commonly associated with plantations and young stands were conspicuous in 1965. At the Institute of Forest Genetics, chemical spraying stopped severe defoliation of valuable hybrid trees by the pine needle-sheath miner. Conspicuous flagging by the gouty pitch midge concerned land managers in some areas.

Infestations of the lodgepole needle miner, pandora moth, fall webworm, and sagebrush defoliator subsided or remained low in 1965. However, a buildup of the western tent caterpillar occurred in some areas.

Suppression activities in 1966 are planned to curb increasing bark beetle buildups in varous areas. Infested trees will be logged to combat the Douglas-fir beetle and the Jeffrey pine beetle. Direct control with chemical sprays will be needed to combat bark beetles in recreation areas and to supplement silvicultural control elsewhere.

Status of Insects

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. The epidemic of this moth, which in 1964 caused severe damage in white fir stands totaling nearly 80,000 acres, declined to a low level. Applied and natural control factors were responsible for the dramatic population reduction.

Only one active tussock moth infestation, some 600 acres in size, was known to exist in California at the end of the year. It was detected in October along Corral Creek Road

in northern Modoc County. An egg-mass survey was made and samples were submitted to the Forestry Sciences Laboratory in Corvallis, Oregon, to determine if virus is present in this population.

White-fir needle miner, *Epinotia meritana* Hein. An infestation of this small moth was detected in red fir throughout nearly 55,000 acres of Sierra National Forest and of the adjoining Yosemite and Sequoia-Kings Canyon National Parks. Defoliation was damaging locally within the infestation, which was the first to be observed in California on red fir. However, death of trees is not an immediate threat because the moth does not feed on the current year's foliage, and, therefore, damage to the affected stands will be determined largely by the persistence of the infestation.

Phantom hemlock looper, *Nepytia* sp. *phantasmaria* (Strecker). Infestations of this moth in Douglas-fir have been discovered in four centers in Shasta and Siskiyou Counties south of McCloud. Some Douglas-fir saplings were almost completely defoliated, while others were less damaged.

F–513791

An undetermined looper, first discovered in outbreak numbers in California in 1965, defoliated Douglas-fir at four separate locations in Shasta and Siskiyou Counties.

Specialists at the Forest Insect Disease Laboratory, Corvallis, detected a fungus and virus infection in specimens from the *Nepytia* sp. populations. These disease organisms may decimate the population before appreciable damage occurs. This moth has been collected only once before in California.

White-fir sawfly, *Neodiprion abietis* complex (Harris), for the third year continued to be active in central and northern California. Egg counts made at Chalk Mountain, Shasta County, showed a declining population. The greatest economic loss was in stands managed for Christmas tree production.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Populations are increasing in Douglas-fir trees damaged or uprooted in northwest California during the floods of December 1964 and January 1965. Many of these logs were salvaged, but some Douglas-fir trees, uprooted by slides or wind, remain to provide breeding material for future infestations. Surveys of storm-damaged sites in August and September revealed that the potential for generating *D. pseudotsugae* outbreaks in the summer of 1966 is high on one-tenth of the sites and moderate on half the sites.

Western pine beetle, *Dendroctonus brevicomis* LeC. Losses from this bark beetle in 1965 remained tolerable in most of central and northern California. The most serious infestations were: Kelly Cabin, Mendocino National Forest; Indian Valley near Hayfork, Trinity County; and Slate Mountain, Plumas County. The degree of infestation in the McCloud Flat area declined.

Several infestations along streams in Siskiyou and Trinity Counties were associated with flood damage. The beetles attacked ponderosa pines damaged by large deposits of silt, and eventually attacked undamaged trees higher on the stream banks. Typical infestations were at Coffee Creek, Boulder Creek, and the South Fork of the Salmon River. Snowbreakage contributed to the outbreak on 1,000 acres at Kelly Cabin.

In southern California, infestations remained active at Lake Arrowhead, San Bernardino County, and at Ranger Peak, Santa Barbara County; tree losses continued in un-

treated infestations at Palomar Mountain, and at Julian, San Diego County.

Jeffrey pine beetle, *Dendroctonus ponderosae* (Hopk.). (*D. jeffreyi* Hopk.). Serious infestations of this beetle were detected in the late summer and fall of 1965 in parts of the Lassen and Plumas National Forests, Lassen Volcanic National Park, and further south near Lake Tahoe. Other infestations occurred on the Sierra and Inyo National Forests and Yosemite National Park.

In southern California, direct control was initiated on infestations at Big Bear Lake, San Bernardino County, and in the Indiana Summit Natural Area, Mono County.

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.). (*D. monticolae* Hopk.). Infestations in lodgepole pine increased sharply in 1965. Some of these outbreaks are of great importance because they are in high-use recreation areas. The location of most of the infestations in creek bottoms or damp meadows may have contributed to the outbreak, since poor soil drainage tends to lower tree vigor, making the trees more susceptible to insect attack.

Young ponderosa pines continued to be killed at Joseph Creek, Modoc County; occasional sugar pines throughout the State were killed by this insect in 1965.

Fir engraver, *Scolytus ventralis* LeC. Detection reports and aerial surveys showed scattered endemic losses in 1965.

Ips (pine engraver), *Ips* spp. At several locations, ips buildups occurred in slash and storm-damaged trees, but did not seriously damage standing trees. The infestations at McCloud Flat in Siskiyou County subsided during the summer. Some ips damage was associated with that caused by the western pine beetle at Kelly Cabin in Lake County. Aerial surveys revealed scattered top killing throughout the State, especially in the Sierra foothills north of Placerville at the 4,000-foot level, and in the southern portion of the Stanislaus National Forest near Groveland.

Red turpentine beetle, *Dendroctonus valens* LeC. Infestations were reported in knobcone pine in one of the campground units near the valuable recreation area of Whiskeytown reservoir, Shasta County. Elsewhere, the beetle occurred only in conjunction with infestations of the western pine beetle, the Jeffrey pine beetle, and the mountain pine beetle.

California flatheaded borer, *Melanophila californica* Van Dyke. Serious tree killing took place only in Garner Valley, Riverside County.

Plantation insects. A variety of insects attacked plantations and young natural stands in 1965. The pine needle sheath miner, *Zelleria haimbachi* Busck, was common in plantations and required suppression at the Institute of Forest Genetics. In Douglas-fir, the Douglas-fir gall midge, *Contarinia pseudotsugae* Condr.; and, in pine, the pine reproduction weevil, *Cylindrocopturus eatoni*

F–513790

A gall midge deformed and damaged the needles on Douglas-fir Christmas trees at several locations in California.

Buch., the pine tip moth, *Rhyacionia zozana* (Kearf.), and the gouty pitch midge, *Retinodiplosis inopis* (O.S.), damaged trees in several locations throughout northern California.

Other insects. The silver-spotted tiger moth, *Halisidota argentata* Pack., was unusually abundant on white fir at Hermit Butte, Modoc County; on Douglas-fir at Titus Ridge, Siskiyou County; and at Elk Mountain, Lake County. Rare sawflies of the family *Xyelidae*, and a blackheaded budworm, *Acleris gloverana* (Wlsm.), were collected from white fir at Knox Mountain, Modoc County. Larvae of the sugar pine tortrix, *Choristoneura lambertianae* complex Busck, destroyed young cones on valuable rust-resistant sugar pines near Sawyers Bar, Siskiyou County. In northern California, the epidemic of sagebrush defoliator, *Aroga websteri* Clarke, has ended.

Moderate infestations of the western tent caterpillar, *Malacosoma pluviale* (Dyar), were reported on bitterbrush near Adin and Fort Bidwell, Modoc County; and near Susanville, Lassen County. Another species, *M. constrictum* Stretch, continues at an epidemic level at Richie Creek, San Diego County, and at San Sevaine Flats, San Bernardino County.

The 4-year epidemic of the fall webworm, *Hyphantria cunea* (Drury), on madrone continued along the Klamath River, but was less damaging. The California oak moth, *Phryganidia californica* Pack., was the most numerous in many years in several Bay Area Counties, and at San Sevaine Flats in southern California. Populations of the lodgepole needle miner, *Recurvaria milleri* Busck, continued to decline in Yosemite National Park. The infestation of the pandora moth, *Coloradia pandora* Blake, continued at a low level

F–513788

Mature pandora moth larvae locally referred to as "Pingas" often are collected by Mono and Piute Indians as a dietary supplement.

F–513789

Second year larvae of the pandora moth consumed much of the foliage from Jeffrey pines at Indiana Summit, Mono County, California.

in Tulare and Kern Counties, but increased to an easily detectible level at Indiana Natural Summit Area, Mono County.

INTERMOUNTAIN STATES

By WILLIAM H. KLEIN
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Conditions in Brief

The mountain pine beetle remained the most damaging forest insect problem in the Intermountain States. Several million lodgepole pines were attacked and over 2.5 million were killed. The most severe outbreaks occurred in western Wyoming and southern Idaho. Control efforts have been successful in certain areas, but in others, epidemics continued to increase in intensity and extent. Greater activity is expected in practically all of the noncontrol areas in 1966.

Spruce budworm populations also continued at a high level, although noticeable defoliation decreased by 800,000 acres under that of 1964. Budworm populations are expected to maintain their current status through 1966. Douglas-fir beetle damage increased in one area in southern Idaho, but elsewhere populations remained static. Other bark beetles remained at endemic levels.

Defoliation of pinyon pine by a sawfly was widespread in western Nevada. In addition, practically all of the lodgepole pine stands in southern Idaho and western Wyoming suffered varying degrees of defoliation by a lepidopterous complex. A small but severe tent caterpillar infestation of Fremont poplar in southern Utah was successfully controlled. Minor infestations of several other defoliating insects continued to attack conifers, hardwoods, and a variety of range plants in all Intermountain States.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.) (*D. monticolae* Hopk.), has, since 1954, caused heavy losses of mature and overmature lodgepole pine in the Intermountain States. Losses were again high in 1965 with more than 2 1/2 million trees killed. The most extensive and spectacular losses occurred on the Teton National Forest and in Grand Teton National Park, western Wyoming, and on the Targhee National Forest, western Wyoming and southern Idaho.

Less spectacular, but nevertheless aggressive infestations continued to deplete lodgepole pine stands on Bureau of Land Management holdings in Idaho and Wyoming; on the Caribou, Boise, and Sawtooth National Forests in southern Idaho; the Cache National Forest in southern Idaho and northern Utah; and on the Bridger National Forest in western Wyoming. Serious past infestations of the mountain pine beetle on the Wasatch and Ashley National Forests in northern Utah have declined.

Although efforts are continuing to reduce the infestations by logging wherever possible, the magnitude of the problem necessitated control by other means—mostly chemical spraying plus some felling and burning. Over 500,000 infested trees were treated by spraying, burning, and logging during 1965. Some 312,000 trees were treated or logged on the Teton Forest alone and 126,000 were treated on Grand Teton Park in a joint effort with National Park Service to suppress the huge infestation in the Jackson Hole area.

Since the Teton outbreak began in 1954, primary infestations have moved northward. Control work areas show considerably fewer new attacks. The main infestation, however, has now moved into the Teton Wilderness area not far from the southern border of Yellowstone National Park, where, due to the tremendous size of the areas infested and the prohibitive cost of treating in inaccessible country, upwards of a million infested trees remain untreated. Unless effective means of natural control develop, a continued northerly movement of infestation centers into the lodgepole stands of Yellowstone Park, with further widespread tree killing, can be expected. Excepting the Wasatch and Ashley infestations, likely to remain static after several years of concentrated control effort, epidemic conditions are expected to continue throughout all infested areas during 1966.

A persistent infestation of mountain pine beetle in second growth ponderosa pine is maintaining its hold on private land near Warner's Pond, southeast of Cascade, Idaho. Over 2,000 "red tops" were observed this year and increased losses are anticipated for 1966. Elsewhere attacks on this species by this beetle have declined.

Spruce budworm, *Choristoneura fumiferana* (Clem.), continued to plague the forests in central Idaho, but the 1964 aerial spraying of more than 500,000 acres aided by natural control factors helped reduce the infestation in 1965. In 1964, spruce budworm infestations throughout the Intermountain States covered almost 2,300,000 acres. This year, 1,500,000 acres of infestation were reported, a reduction of 800,000 acres. Serious infestations still persist, however, on the Salmon, Challis, Payette, and Targhee National Forests. Biological data indicates no letup in intensity or extent of damage during 1966.

Elsewhere, relatively minor budworm infestations continued. One on the Fishlake National Forest in southern Utah, discovered in 1964, spread into new areas but diminished in others with no apparent increase in infested acreage. Another 10,000 acres of subalpine and Douglas-fir were damaged by spruce budworm on the Bridger Forest. Light defoliation is expected in both of these areas during 1966.

A pilot test in southern Idaho demonstrated the effectiveness of aerially applied malathion (low volume) against budworm-infested Douglas-fir. The test area of 8,000 acres was typical of many Douglas-fir stands in the four-State region. Two areas were sprayed at a rate of 13 ounces per acre, and a third area received a 9-ounce-per-acre application. In both of the higher dosage areas 90 percent mortality was achieved; in the low dosage area only 71 percent kill was obtained. Coordinating studies by wildlife biologists reported no significant adverse effects of malathion on either wildlife or fish within the test area. An increase in insects adrift in the stream was noticeable immediately after spraying but bottom sampling showed little change in the total population of aquatic insects.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk., infestations on the Sublette Division of the Sawtooth Forest in southern Idaho remained epidemic despite a continued salvage logging program. Continued losses are expected in 1966, but most of the trees now being infested will be salvaged. New centers of Douglas-fir beetle activity were reported on the Caribou Forest in Idaho and the adjoining Cache Forest in northern Utah.

Damage caused by this beetle decreased in some areas and increased in others, but generally remained at the 1964 level.

Western pine beetle, *Dendroctonus brevicomis* LeC., continued to destroy mature and overmature ponderosa pine in localized areas on the Boise and Salmon Forests in southern Idaho, and on the Dixie National Forest in southern Utah. However, none of the infestation centers reached epidemic levels, and beetle populations are not expected to increase significantly during 1966.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.). (*D. engelmanni* Hopk.). Continued suppressive action through logging and chemical spraying has reduced populations of this beetle to low levels in the spruce stands in the Intermountain States. One small infestation is still active within a logging sale area on the Dixie Forest, but removal of infested slash should reduce the beetle hazard there to a tolerable level.

Fir engraver, *Scolytus ventralis* LeC. Aerial surveys revealed increased mortality of subalpine fir in many areas. The primary causal agent was first thought to be the fir engraver but subsequent ground examinations disproved this. In some areas the beetle was moderately active; in others, however, no symptoms depicting a disease or other insect activity could be found. This unknown mortality factor made it difficult to determine the status of the fir engraver this year.

Tussock moths, *Hemerocampa* spp. and *Halisidota* spp. Small localized infestations of the Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD., are again causing light to heavy defoliation of about 3,500 acres of Douglas-fir near Silver City, Owyhee County, Idaho. Egg mass surveys indicate continued defoliation trends in 1966.

A late hatch of the western tussock moth, *Hemerocampa vetusta* (Bdv.), continued to cause moderate to severe defoliation over a wide area of bitterbrush range between Reno and Carson City, Nev. The infestation is expected to continue at its present level at least through 1966.

Another species of *Hemerocampa* has caused moderate to severe defoliation of ponderosa pine saplings, bitterbrush, Ceanothus and other broad-leaved plants on the Boise Basin Experimental Forest and Town Creek Plantation within the Boise Forest, since 1959. In 1961 a similar outbreak was controlled to protect the pine reproduction. Since 1962, the moth has slowly but steadily increased in numbers. Larvae fed on brush species and ponderosa pine saplings during 1965. New egg masses were plentiful this fall, so continued defoliation is expected in 1966.

Serious infestations of other tussock moths, *Halisidota ingens* Edws., occurring on pinyon pine, and *H. argentata subalpine* French, on juniper in the Uintah and Ouray Indian Reservation, Utah, have been reduced to a low level by natural factors. No signs of defoliation were noted in 1965.

A sawfly, *Neodiprion edulicolus* Ross. A sudden and dramatic population explosion of this sawfly caused severe defoliation, branch killing, and limited tree mortality of single leaf pinyon pine in southwestern Nevada. This infestation, first observed in 1958, collapsed in 1961 but recurred in 1965 on more than 250,000 acres. Pinyon pine, long regarded as noncommercial except for fuel and its edible seed, is now a highly regarded and commercially valuable Christmas tree.

Pupal parasitism by an undetermined chalcid was exceptionally heavy in some areas and may contribute to a significant population decline in these same areas in 1966. In other areas, however, sawfly emergence and deposition of eggs was high. The status of the infestation will not be known until spring when overwintering survival of the eggs will be more fully evaluated.

Lodgepole pine terminal feeders. A complex of lodgepole pine terminal feeders, *Argyrotaenia* spp.; the jack pine budworm, *Choristoneura pinus* Free.; a budworm, *Choristoneura lambertiana* (Busck); and the pine needle sheath miner, *Zelleria haimbachi* Busck, caused moderate to severe defoliation in practically all of the lodgepole pine stands in southern Idaho and western Wyoming during 1965. Trees examined in the Island Park area of the Targhee Forest, Idaho, suffered complete defoliation of this year's growth. Trees in other areas were 25 to 75 percent defoliated. However, no tree mortality has been observed in any of the infested areas. Defoliated trees usually refoliate in the spring, but many are permanently deformed or stunted. The infestation is expected to continue and spread into new areas. No control is planned.

F–513633

The pinyon pine sawfly occurred in outbreak numbers over a large acreage in Nevada in 1965. Here larvae feed in typical gregarious fashion.

Tent caterpillars, *Malacosoma* spp. Tent

caterpillars caused heavy to severe defoliation of Fremont poplar in southern Utah, from St. George, east along the Virgin River into Zion National Park. Near-epidemic populations have persisted in this area for several years and the absence of natural enemies indicates continued defoliation for 1966. In Zion Park, a control program was undertaken in 1965. Some 1,000 acres were treated by mistblower application of *Bacillus thuringiensis*. Overall control results were good.

Malacosoma sp., a defoliator of bitterbrush, was active in southern Utah. *B. thuringiensis* was also used to control a moderate infestation in Bryce Canyon National Park, but the microbial insecticide's effectiveness was masked by the sudden appearance of a lethal cytoplasmic polyhedrosis virus. Heavy larval mortality was followed by a sudden drop in egg mass counts, indicating that negligible defoliation of bitterbrush in Bryce Canyon Park can be expected in 1966. Status and trend of this tent caterpillar elsewhere in southern Utah are unknown.

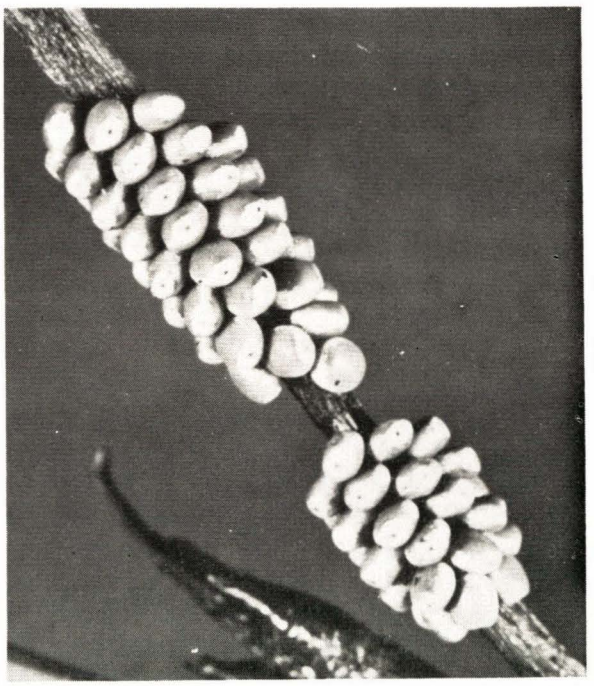
A geometrid, *Anacamptodes* sp., severely defoliated stands of mountain mahogany in the Juniper Mountains, Owyhee County, Idaho, during 1962–63. Populations have decreased yearly, and now the infestation is at a low ebb. Relatively little defoliation is expected in 1966.

White-fir needle miner, *Epinotia meritana* Hein. Predicted increases in damage to white fir in southern Utah by this pest did not occur, probably due to early storms during the 1965 moth flight. Only negligible defoliation occurred in Bryce Canyon Park and the Dixie Forest. The forecast for 1966 is for the same or slightly less damage.

Aspen leaf tier, *Sciaphila duplex* (Wlsm.). Populations of aspen leaf tier have been epidemic in aspen stands of Utah since 1961. In 1965 about 50,000 acres were heavily defoliated on the Fishlake and Dixie Forests, Utah. Damage increased during 1965 in the Sheep Valley and the UM Pass areas on the Fishlake Forest where leaf tier infestations were first detected, and is expected to be heavy again in 1966. The large aspen tortrix, *Choristoneura conflictana* (Wlk.), prominently associated with all aspen leaf tier infestations, moderately defoliated 3,000 acres on the Aquarius Plateau, Dixie Forest. Number of acres infested is expected to decrease in 1966.

Pitch nodule moth, *Petrova albicapitana* var. *arizonensis* Hein. Pitch nodule moth populations were epidemic on several thousand acres of pinyon pine in the four-State region. Tip killing was considerably heavier this year than last on Bureau of Land Management stands and on the nearby Dixie Forest, making many trees unfit for Christmas trees. This fall, populations were significantly reduced by natural factors. Although the area of infestation will likely remain unchanged, tip killing is expected to be light in 1966.

Other insects. Aspen leaf miner, *Phyllocnistis populiella* Chamb., populations persisted in aspen stands of southeastern Idaho, western Wyoming and northern Utah. Epidemic populations of a grass plant bug, *Labops* sp., on crested wheat grass were re-



F–513635

Egg masses of a sheep day moth, a serious defoliator of range plants in the Intermountain States.

duced to a low level on Asay Bench, Dixie Forest. Heavy populations of this same insect are increasing and damage in expected to be severe in the Pine Valley seedling area, Dixie Forest, in 1966. Heavy infestations of *Cinara* sp. were observed on Jeffrey pine in western Nevada near Twin Lakes, Toiyabe National Forest, and on pinyon pine in South Canyon, Dixie Forest, southern Utah. Mealybug populations, *Puto* sp., remained epidemic in Engelmann spruce stands, Dixie and Fishlake Forests, Utah, and on mixed conifer stands in the Payette Forest, Idaho.

Populations of a spittlebug, *Clastoptera* sp., increased in juniper stands in southwestern Utah and eastern Nevada this year. Twig killing was evident in most juniper stands east of Cedar City, Utah, Dixie Forest. The red turpentine beetle, *Dendroctonus valens* LeC., was active in small localized ponderosa pine stands of the Salmon Forest, Idaho. Outbreaks of *Aroga websteri* Clarke on sagebrush, and sheep day moth, *Pseudohazis* sp., on other range plants occurred in localized areas. *Dioryctria* sp. caused moderate damage to pinyon pine cones in areas of eastern Nevada. An unknown geometrid caused light to moderate defoliation of white fir in Timpanogas Cave National Monument in northern Utah.

NORTHERN ROCKY MOUNTAINS

By SCOTT TUNNOCK, Division of State and Private Forestry, Missoula, Mont.

Conditions in Brief

The mountain pine beetle was the most destructive bark beetle in the northern Rocky Mountain region of Montana, northern Idaho, and northeastern Washington. It killed millions of board feet of mature white pine in Idaho and infested many ponderosa pine stands in Montana. Infestations also remained chronic in several lodgepole pine forests in Montana. Douglas-fir beetle infestations decreased on the Flathead and Kootenai National Forests, Mont., and Nezperce National Forest, Idaho. They increased, however, on the Bitterroot, Gallatin, and Helena National Forests, Mont. Damage by the fir engraver was heavy within 15,000 acres east of Big Fork, Mont.

A major outbreak of Douglas-fir tussock moth, which developed in 1964, defoliated 225,000 acres of grand and Douglas-fir in Latah and Benewah Counties, Idaho. However, aerial spraying and a virus disease brought the outbreak under control. Two active minor infestations in northwestern Montana also collapsed by October. The long-standing infestations of spruce budworm continued in Montana and Idaho, and damage to host trees was apparent on 2,283,640 acres. The population trend, however, is believed to be downward.

Populations of the larch casebearer, which started to develop near St. Maries, Idaho, in the early 1950's, continue to spread throughout the larch type of the northern Rocky Mountain region. Infestations of a larch bud moth have been increasing since 1963. About 140,000 acres of larch were defoliated in the northern tip of Idaho and northwestern Montana in 1965. Damage by the larch sawfly decreased in northern Idaho, but increased in Montana. A larch looper infested several thousand acres near Libby and at the head of the Swan River in Montana. A pine tussock moth epidemic was recorded for the first time in 42,000 acres of ponderosa pine around Ashland and Fort Howes, Mont. A spruce bud moth caused some defoliation of Englemann spruce and subalpine fir in Yellowstone National Park. Minor damage by the cottonwood leaf beetle, Douglas-fir needle midge, and pine needle-sheath miner was detected in Montana.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.) (*D. monticolae* Hopk.) This was the most destructive bark beetle in the northern Rocky Mountain region during 1965. It continued to destroy millions of board feet of mature white pine, infested many ponderosa pine stands, and several lodgepole pine forests.

The greatest losses in mature white pine

F–513644

stands occurred on the St. Joe, Clearwater, Coeur d'Alene, and Kaniksu National Forests in Idaho. Killed trees were scattered throughout about 42,000 acres on the St. Joe Forest, mainly within tributaries along the St. Joe River, North Fork Clearwater River, Little North Fork Clearwater River, Stony Creek, and East Fork Potlatch Creek. Dead trees were numerous on about 105,000 acres of timber on the Clearwater Forest, and infestation centers could be found wherever mature white pine stands predominated. The number of killed trees increased along subdrainages of the North Fork Coeur d'Alene River, where more than 100 groups containing from 5 to 50 infested trees were observed. Losses in mature white pine stands on the Kaniksu Forest decreased, although some killing was detected near the head of the Upper Priest River in the Caribou, Ball, Boulder, and White Pine Creek drainages.

Groups of up to 100 dead and infested ponderosa pine trees occured in four areas on the Lewis and Clark Forest, Mont., within the Judith River drainages and Big Snowy Mountains. These infestations are expected to decrease in 1966. The number of killed ponderosa pine trees increased along the Kootenai and Fisher River drainages in Montana.

Lodgepole pine stands that have been continually attacked for many years in Montana contained fewer infested trees in 1965 than previously. These stands are located near the headwaters of the Yaak River, within Glacier National Park, and along the Gallatin River drainage.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Infestations and resultant tree killing increased on the Bitterroot, Gallatin, and Helena National Forests, Mont. They decreased, however, on the Flathead and Kootenai Forests, Mont., and the Nezperce Forest, Idaho. Outbreaks on the Bitterroot Forest centered along the headwaters of the East Fork and West Fork Rivers; those on the Gallatin were in the Bridger Mountains

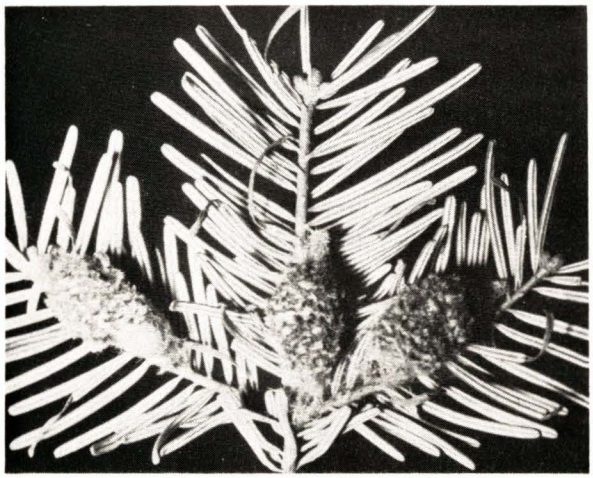
Predation of mountain pine beetle larvae by woodpeckers helped check lodgepole pine infestations in Glacier National Park, Montana.

and on Porcupine Butte. Worst-hit areas in the Helena Forest were northeast of Lincoln and drainages near the head of Canyon Creek.

Fir engraver, *Scolytus ventralis* LeC. Damage by this beetle in grand and subalpine fir stands was less than in 1964, and the only major infested center was in 15,000 areas east of Big Fork, Mont.

Larch engraver beetle, *Scolytus laricis* Blkm. A small infestation was reported in the Lone Cabin Creek drainage on the Kootenai Forest, Mont. The beetles attacked limbs on western larch trees.

Oregon pine ips, *Ips pini* (Say). (*I. oregonis* Eichh.). A few ponderosa pines were killed north of Keuterville, Idaho, along the west side of the Bitterroot Valley, Mont., and from Missoula into the Ninemile drainage in Montana.



F–513647

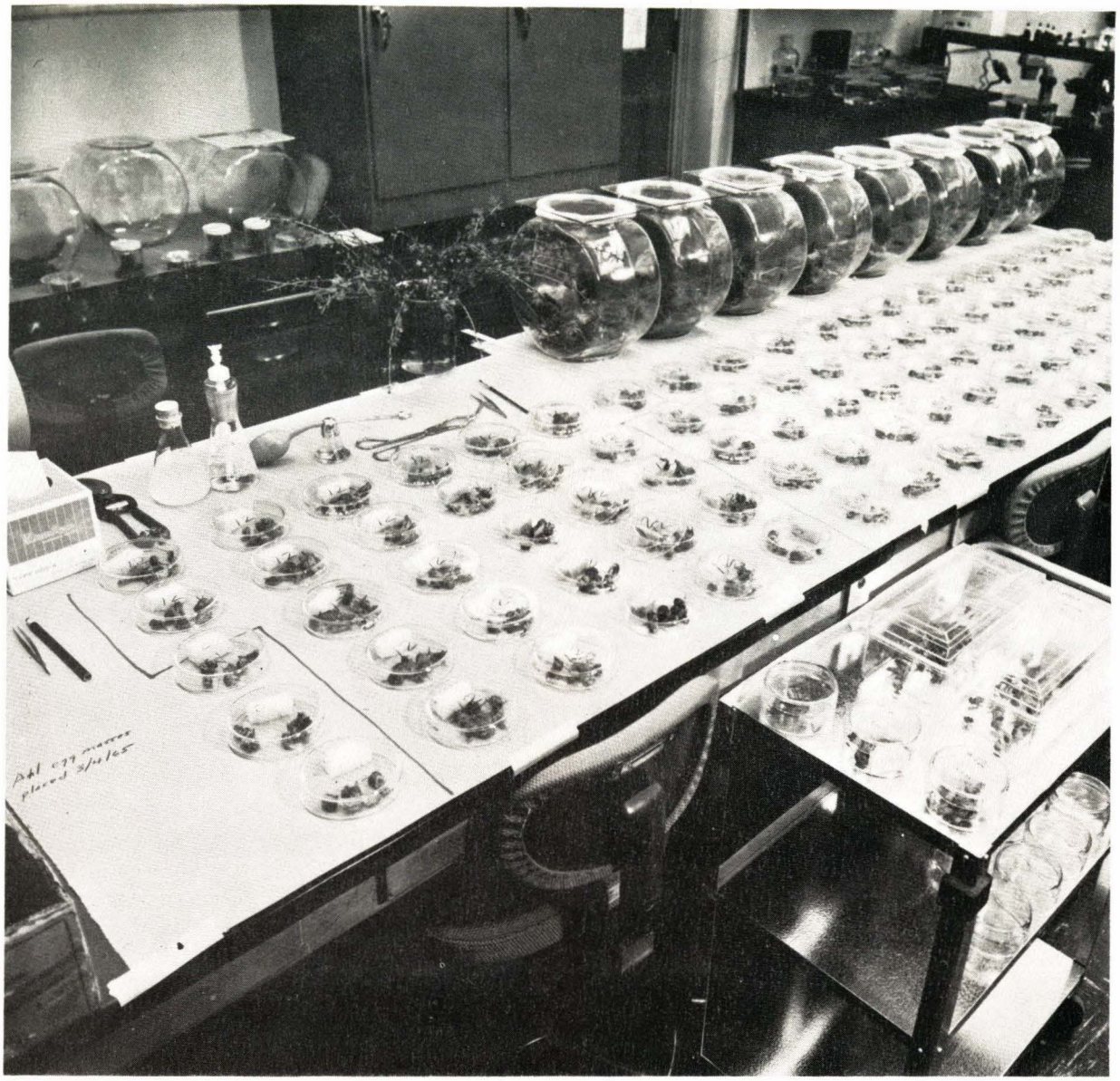
Douglas-fir tussock moth egg masses are laid on old tussock moth cocoons. Moscow, Idaho.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Artificial and natural controls checked the outbreak of this important pest on some 225,000 acres in Latah and Benewah Counties, Idaho. Spot infestations near Polson, and south of Elmo, Mont., collapsed from natural factors alone. DDT at the rate of three-fourths pound in 1 gallon of fuel oil per acre was sprayed on 190,000 acres of the infestation in Idaho to protect the resource under attack. This and the infection of larvae by a polyhedrosis virus and parasites were responsible for bringing the outbreak under control. Effects of a virus spray using 1 billion polyhedra per acre were not conclusive.

Spruce budworm, *Choristoneura fumiferana* (Clem.). The long-standing outbreaks of this insect continued in the Douglas-fir and true fir stands of Montana and Idaho, causing heavy damage. The Montana infestation remained at an estimated 1.9 million acres. In Idaho, however, a great increase occurred, from 329,000 to 501,000 acres. Nevertheless the trend of infestations in both states is believed downward as evidenced by measurement of budworm egg masses on the foliage of infested trees and other factors.

Larch casebearer, *Coleophora laricella* (Hbn.), continued its spread through the 2.5 million acres of western larch in Idaho and Montana. Nearly 2 million of the infested acres extended from eastern Washington east to Elmo, Mont., and from the Canadian border south to the Lochsa River, Idaho. To combat the very heavy defoliation occurring annually in Idaho, larch casebearer larvae parasitized by *Agathis pumila* (Ratz.), were brought in from Massachusetts. As adult wasps emerged, they were confined on trees heavily infested with casebearer larvae north of Priest River, Idaho. Progeny of the wasps will be further distributed in the spring of 1966 to other infested areas. It is planned to spray about 4,000 acres of infested stands in two Idaho State Parks in 1966. Spraying will be from the air with 8 fluid ounces of technical malathion per acre.

A larch bud moth, *Zeiraphera* sp. Outbreaks of this moth, believed to be *Z. griseana* (Hbn.), are cyclic in the northern Rocky Mountain region. The last outbreak causing noticeable damage occurred about 10 years ago, and it has been increasing since 1963. In 1965, more than 72,000 acres were defoliated on the Kootenai Forest from south of Troy, Mont., to the Canadian border east to the Kootenai River. Kaniksu Forest lands in Idaho contained about 56,000 acres of infestations



F–513645

Large numbers of Douglas-fir tussock moth larvae were reared in the laboratory to propagate a polyhedrosis virus disease, aimed at control of this pest. Missoula, Montana.

from south of Bonners Ferry to Canada. East-facing slopes within the Swan River drainage, Flathead Forest, harbored 12,000 acres of heavily defoliated stands in Montana.

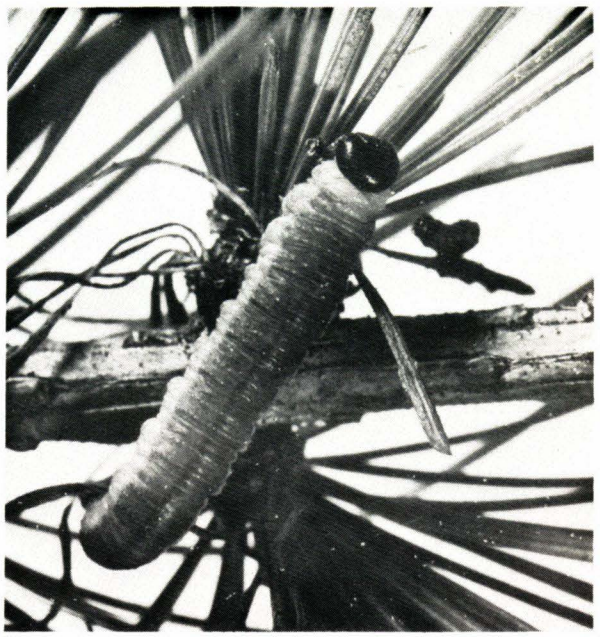
Larch sawfly, *Pristiphora erichsonii* (Htg.). Damage by this insect decreased in northern Idaho, but increased in Montana where about 15,000 acres were heavily defoliated on the Tally Lake District, Flathead Forest, and 4,000 acres in the Sunday Creek drainage to the north. Many larch stands on some 25,000 acres within tributaries of the Little North Fork Clearwater River drainage in Idaho also were defoliated. In addition, five areas were defoliated on the Clearwater Forest from Musselshell north to the North Fork Clearwater River, the largest of which contained about 5,000 acres.

A larch looper, *Semiothisa* sp. Infestations of this looper, probably *S. sexmaculata* Pack., have become more abundant each year since 1963 in Montana. Several thousand acres of larch were noticeably damaged on the Raven Ranger District south of Libby. It was also reported in abundance near the head of the Swan River Valley.

F–513649

Small larch trees were encaged in cheesecloth to confine parasites of the larch casebearer which were liberated therein to control this pest. Priest River, Idaho.

A pine tussock moth, *Dasychira* sp. A major epidemic of this moth, believed to be *D. plagiata* (Wlk.), was recorded for the first time in eastern Montana. About 42,000 acres of defoliated ponderosa pine were visible from the air, and the moth was found in 250,000 acres around Ashland and Fort Howes, Mont. The epidemic is expected to increase during 1966.



F–513767

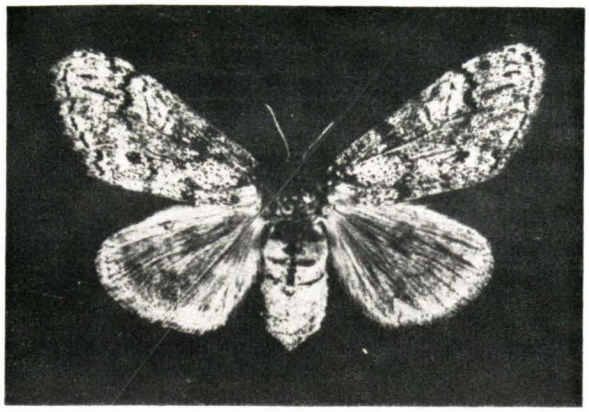
The larch sawfly was abundant and damaging to affected stands at many locations in Washington, Idaho, and Montana in 1965.

A spruce bud moth, *Zeiraphera* sp., probably *Z. ratzeburgiana* Sax., defoliated several areas of Engelmann spruce and subalpine fir in Yellowstone National Park. It was not reported from any other area.

Cottonwood leaf beetle, *Chrysomela scripta* Fab. This leaf-feeding beetle occurred on many cottonwood trees near Ashland, Mont.

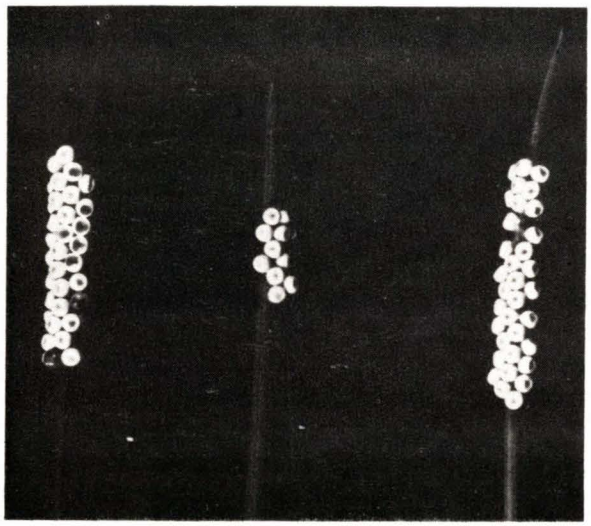
Pine needle sheath miner, *Zelleria haimbachi* Busck. Populations of this moth were at their highest during 1963 when nearly 200,000 acres of lodgepole and ponderosa pines were infested in Montana. By 1965, only minor damage was reported.

Douglas-fir needle midges, *Contarinia pseudotsugae* Condr. and *C. constricta* Condr. These two midges caused very little damage to needles of Douglas-fir in 1965. This seems to be the ebb of a population cycle that began in 1957 and reached its peak during 1962–63.



F–513643

An outbreak of an undetermined pine tussock moth occurred in ponderosa pine in the vicinity of Ashland and Ft. Howes, Custer National Forest, Montana.



F–513642

Egg masses of an undetermined tussock moth on needles of ponderosa pine. Custer National Forest, Montana.

CENTRAL ROCKY MOUNTAINS

By AMEL E. LANDGRAF JR., Division of Timber Management
Denver, Colo.

Conditions in Brief

Black Hills beetle populations through most of the Central Rocky Mountains were reduced to their lowest level since the early 1950's primarily by strong suppression programs of Federal, State, and private land managers, with assistance from beneficial insects and weather.

A potentially serious buildup of Engelmann spruce beetle populations may occur in spruce stands on the San Juan, Grand Mesa-Uncompahgre and Gunnison National Forests, southwestern Colorado, that were exposed to high winds in the winter and spring of 1965. Heavy wind damage occurred in 5 areas. Fortunately, trees in only two of these areas were found heavily infested and many of these can be salvaged. Trees which cannot be salvaged may require chemical treatment.

Trap trees were used to prevent an Engelmann spruce beetle outbreak on the southern end of the Green Horn Mountains, San Isabel National Forest, Colorado. Sixteen hundred infested trees were found on the north end of the Green Horn Mountains. Fortunately, most of these trees can be salvaged before the beetles emerge.

The spruce budworm caused heavy defoliation of 79,000 acres of true firs and Douglas-fir on the San Isabel and San Juan Forests in southern Colorado. The intensity of defoliation is expected to be about the same in 1966.

Although numerous tents of two species of tiger moths occurred throughout the ponderosa and pinyon pine type in Colorado, defoliation was generally light. A new outbreak of pandora moth, the first since 1937–39, was discovered on the Arapaho National Forest.

Status of Insects

Black hills beetle, *Dendroctonus ponderosae* (Hopk.). The serious outbreak of this beetle in the Black Hills of South Dakota and Wyoming was brought under control in 1965. During 1965 the Forest Service; Homestake, Bald Mountain and Deadbroke Mining Companies; Bureau of Land Management; National Park Service; and the State Forest Services of South Dakota and Wyoming and Lawrence County treated 18,700 infested trees.

Land managers were aided in their control effort by a sharp increase in numbers of two beneficial insects, the clerid beetle, *Enoclerus sphegeus* F., and the predaceous fly, *Medetera aldrichii* Wh. Several species of mites

were also observed in abundance on many of the adult beetles. Although their overall effect on the beetle is not fully understood, it is believed they lower the female's egg-laying capacity. One species is believed to be an egg predator, the others are probably free-living forms.

Cold, wet weather in August and September 1964 also took a heavy toll of adult beetles that were migrating from old beetle-killed trees to green trees, and undoubtedly this helped to prevent the outbreak from increasing. A small cooperative project will be needed in 1966 to clean up scattered beetle infestations on private lands.

In the Big Horn Mountains of north central Wyoming, Federal and State land managers were also successful in reducing Black Hills beetle infestations. The Bureau of Land Management, the Forest Service, and the Wyoming State Forest Service treated 9,400 infested trees in 1965. Entomological data collected in the affected area indicates that beetle numbers are on the decline due to natural control factors, primarily beneficial insects.

The intensity of the outbreak on the Medicine Bow National Forest declined slightly in 1965. Prolonged cold weather at the time the beetles were ready to emerge, forced about half of the brood to overwinter. Woodpeckers will find these overwintering brood attractive prey.

In Colorado, the Forest Service, National Park Service, Bureau of Land Management, Colorado State Forest Service, Denver Mountain Parks, and the Mountain Parks Association successfully brought an outbreak along the Front Range under control. Except for a small infestation on private lands southwest of Littleton, control will not be necessary in 1966. Biological evaluations indicate beetle populations will be held in check by beneficial insects.

Over on the western slope the San Juan Forest discovered a small Black Hills beetle outbreak north of Dolores, Colo. An estimated 400 polesized ponderosa pine were killed in 1965. This infestation will be treated in 1966. An infestation on the Uncompahgre Plateau, Grand Mesa-Uncompahgre Forest, was brought under control by treating 680 infested trees.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.). (*D. engelmanni* Hopk.), maintains a high endemic population level by breeding in windthrown spruce. During years when high winds cause an unusual amount of windthrow, beetle populations increase rapidly. Such a situation occurred in 1965. Severe winds during the winter and spring months blew down hundreds of spruce trees on the San Juan, Grand Mesa-Uncompahgre and Gunnison Forests. Insect survey crews found 5 areas where blowdown was unusually heavy. Fortunately, trees in only two of the areas, headwaters of Mancos River, San Juan Forest and Middle Fork of Cimarron River, Grand Mesa-Uncompahgre Forests, were found to be heavily infested. Some of the infested trees can be salvaged, the remainder will have to be treated.

Foresters and entomologists are even more concerned with areas where blowdown is less intense but occurs over large areas of inaccessible type. The real danger here is of additional blowdown occurring just before the beetles emerge from the present windthrow. Such a situation could trigger a serious spruce beetle outbreak. More intensive surveys and evaluation will be made in 1966 to determine likely trouble spots.

An Engelmann spruce beetle outbreak involving 1,600 trees was discovered in the fall months on the north end of the Green Horn Mountains, San Isabel Forest. Fortunately, most of the infested trees can be salvaged. The remainder may have to be treated in 1966. On the south end of the Green Horn Mountains trap trees were used to prevent an outbreak. These trap trees will be salvaged or burned in 1966.

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.). (*D. monticolae* Hopk.). A small outbreak was discovered late in 1965 southwest of Lander, Wyo, Shoshone National Forest. The 400 infested trees will be piled and burned during January-March 1966. Elsewhere in northwestern Wyoming, east of

the Continental Divide, populations remained at an endemic level.

Spruce budworm, *Choristoneura fumiferana* (Clem.), infestations persist in southern Colorado on some 79,600 acres of fir type. Heaviest defoliation occurred in the Vallecito Reservoir, Florida River and Little Sand Creek areas, San Juan Forest; eastern slope of the Sangre de Cristo Mountains, San Isabel Forest; and Soap Creek drainage, Gunnison Forest. Although damage was heavy with more than 60 percent of the current foliage destroyed, it was not severe enough to cause top-killing or tree mortality. Defoliation is expected to remain heavy in 1966. There are no plans to suppress infestations in 1966.

Pandora moth, *Coloradia pandora* Blake. A new outbreak was discovered in North Battle Creek, southwest of Granby, Colo., the first in 26 years on the Arapaho Forest. The 1937–39 outbreak covered 100,000 acres before a wilt disease brought it under control. The present infestation appears plagued by disease as numerous dead caterpillars were seen hanging from branches. Since the insect has a 2-year life cycle, damage, if any, will be most noticeable in 1967.

Tiger moths, *Halisidota ingens* Edws. and *H. argentata* Pack. Numerous tents of these two tiger moths were found throughout the ponderosa pine and pinyon pine type in Colorado. The last time these insects were reported in such abundance was 1956. Heaviest feeding of *H. ingens* occurred in the Black Forest northwest of Colorado Springs. *H. argentata* was found to be most abundant on Kannah Creek southwest of Grand Junction. Elsewhere damage by the two species was hardly noticeable.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch), infestations appear to be on the increase in Colorado. Aspen stands in the Cumbres Pass area, Rio Grande National Forest, plagued by this defoliator for many years, were completely defoliated in 1965. Natural control brought a persistent outbreak in this same area under control in 1960.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Although this insect has never been a serious problem in the Central Rocky Mountains, its presence causes concern as it is regarded as the most serious defoliator of Douglas-fir and true firs in the West. This year the insect was found on blue spruce and Douglas-fir, planted as ornamentals, at Monument, Colo.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Persistent infestations on Devil Mountain, San Juan Forest and Powderhorn area southwest of Gunnison, Colo, changed very little from that of a year ago. Elsewhere in the Central Rocky Mountains, beetle populations remained endemic.

Oregon pine ips, *Ips pini* (Say). (*I. oregoni* Eichh.). This bark beetle continued at endemic levels. Above average precipitation has kept trees in good growing condition, an unfavorable environment for the beetles which normally attack weakened trees. Populations are expected to remain endemic in 1966.

SOUTHWESTERN STATES [1]

By D. D. LUCHT, Division of Timber Management[2]
Albuquerque, N. M.

Conditions in Brief

The spruce budworm was the No. 1 enemy of Southwestern forests in 1965. It damaged mixed-conifer stands on 470,000 acres, including 50,000 heavily defoliated in a new outbreak near Taos, N. M. Defoliation on the remaining 420,000 acres of older infestations either declined or remained static. The budworm overshadowed another serious defoliator, the white fir needle miner, a newcomer to the Southwest. Recorded for the first time in 1964, this miner heavily defoliated white fir on about 62,000 acres in northern Arizona in 1965. Two tussock moths, previously unobserved, became important by stripping broadleaf trees in high-use recreation areas of southern New Mexico. Pine tip-moths, previously of little economic concern, heavily damaged planted ponderosa seedlings in north-central Arizona.

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[1] Includes all forested lands in Arizona and New Mexico and National Park Service land in southern Colorado and western Texas.

[2] Seed and cone insect information submitted by Dr. H. Grant Kinzer, New Mexico State University, Las Cruces.

The most destructive bark beetles were the Douglas-fir beetle and the Engelmann spruce beetle. The former continued to kill Douglas-fir trees throughout the Region, but the latter continued epidemic only on Mt. Taylor in central New Mexico. The Arizona five-spined ips and the roundheaded pine beetle continued to kill ponderosa pine. However, the number of trees killed by each was much less than in 1964. The Black Hills beetle remained active at a low level in ponderosa pine in the Manzano Mountains of central New Mexico. Several species of seed and cone insects caused heavy damage to ponderosa and Douglas-fir seed and cone crops on the Lincoln and Gila National Forests of southern New Mexico.

Cultural control was directed against the Engelmann spruce beetle and the Arizona five-spined ips. Direct control was used against the Great Basin tent caterpillar, with excellent results. In a preliminary field test, a biological agent was used with satisfactory results on the Nevada buck moth. Except for the Engelmann spruce beetle, control was directed against infestations in scenic or high-use recreation areas and on valuable watersheds.

Status of Insects

Spruce budworm, *Choristoneura fumiferana* (Clem.). About 470,000 acres of mixed-conifer are infested by this pest in New Mexico. This total includes a new 50,000-acre infestation on the Carson National Forest near Taos. Half of the new outbreak is within the area sprayed in 1962; the remainder adjoins on the north. The infestation is rapidly spreading and intensifying. Control is planned to prevent re-invasion of additional areas treated in 1962. The older infestations either decreased in size or remained static. The one on non-Federal lands near Chama and Cimarron decreased slightly, from 350,000 to 310,000 acres. Of the two in southern New Mexico, the one on the Gila National Forest decreased from 40,000 acres to 20,000 acres, while on the Lincoln National Forest, the infestation remained static at 90,000 acres.

White-fir needle miner, *Epinotia meritana* Hein. The needle miner became epidemic and heavily defoliated about 60,000 acres of white fir along the common boundary of Grand Canyon National Park and Kaibab National Forest in northern Arizona. Near Cape Royal, within the Park, the miner heavily defoliated 2,000 more acres. Defoliation is expected to intensify in 1966 and cause limited deterioration of the stand. Since white fir is a major species in the area, its destruction jeopardizes scenic and recreation values.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.). (*D. engelmanni* Hopk.) The 5-year cultural control program against the Engelmann spruce beetle on the Carson National Forest near Taos, N. M., was terminated with the burning of 1,800 acres of infested debris. During this 5-year period, 11,600 acres of cull, slash and other infested material was burned. The beetle continued to kill mature spruce on Mt. Taylor near Grants, N. M. However, woodpeckers, important predators, reduced 1964 broods to an endemic level. Logging and burning of infested debris continued. At the Snow Bowl Ski Area near Flagstaff, Ariz., the permittee continued these sanitation measures in disturbed areas of spruce type.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch). This indigenous pest diminished throughout the Southwest except in the Pinal and Huachuca Mountains in southern Arizona, where its large numbers and unsightly defoliation marred scenic and recreation areas. In northern New Mexico, small infestation pockets shifted and reduced activity. Suppression was successful on 22,500 acres of aspen on National Forest, National Park, and Indian lands in northern Arizona.

Arizona five-spined ips. *Ips lecontei* Sw. The infestation near Prescott, Ariz., became less active. At Oak Creek Canyon Recreation Area near Sedona, Ariz., 218 infested ponderosa pine were cut and burned in January 1965, to destroy the overwintering brood. Only 12 dead trees were found in the control area in September, 1965.

Black Hills beetle, *Dendroctonus ponderosae* (Hopk.). The outbreak on Mountainair Dis-

F-513640

A polyhedrosis virus for use in controlling the Great Basin tent caterpillar was propagated in a field population in 1965. Kaibab National Forest, Arizona.

trict, Cibola National Forest, near Albuquerque, was at a low level. Active but less aggressive populations continued to kill ponderosa pine and limber pine near old infestation centers.

Roundheaded pine beetle, *Dendroctonus adjunctus* (Blandf.). Two infestation centers remain active. The center at Riggs Lake Recreation Area, Safford, Ariz., declined due to chemical control efforts of the previous year. The other at Ruidoso, N. M., barely persists in scattered pole-size ponderosa pine.

Douglas-fir beetle, *Dendroctonus pseudotsugae* (Hopk.). Douglas-fir mortality continued at a moderate rate in fringe type throughout the Southwest. On Bill Williams Mountain near Williams, Ariz., most of the mature trees have been killed. On the Northern Division of the Kaibab, heavy mortality continued in several thousand acres of continuous Douglas-fir type. Logging was used where feasible for control. At Mesa Verde National Park, Colorado, 100 trees were killed on the approach road to the cliff dwellings.

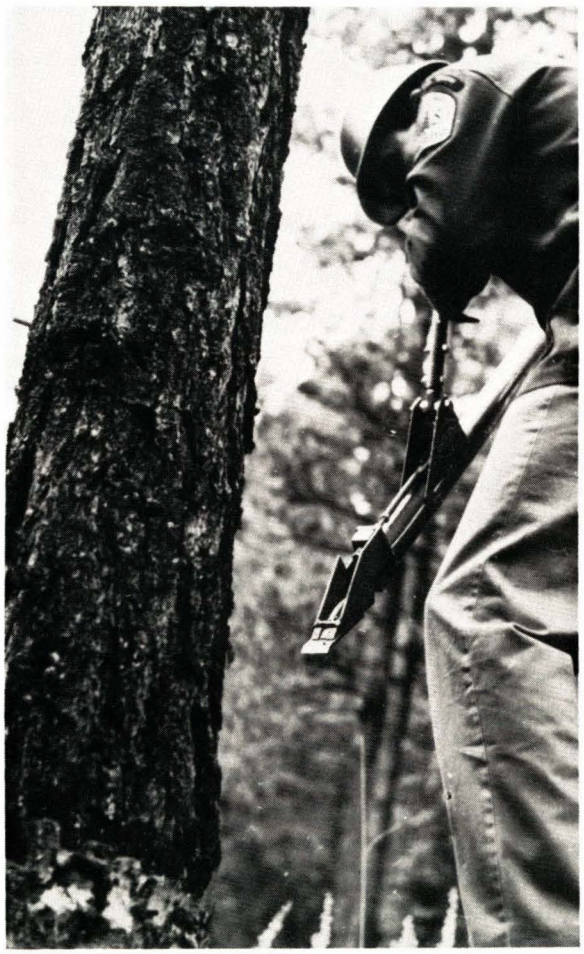
Nevada buck moth, *Hemileuca nevadensis* (Stretch.). This gregarious defoliator continued to strip native cottonwoods at White Sands National Monument near Alamogordo, N. M. A preliminary field test with Thuricide 90 TS applied by mist blower resulted in high mortality to this pest. Further tests are planned in 1966.

Pinyon needle scale, *Matsucoccus acalyptus* Herb. This sapsucking pest remains static at a moderate level on the South Rim of Grand

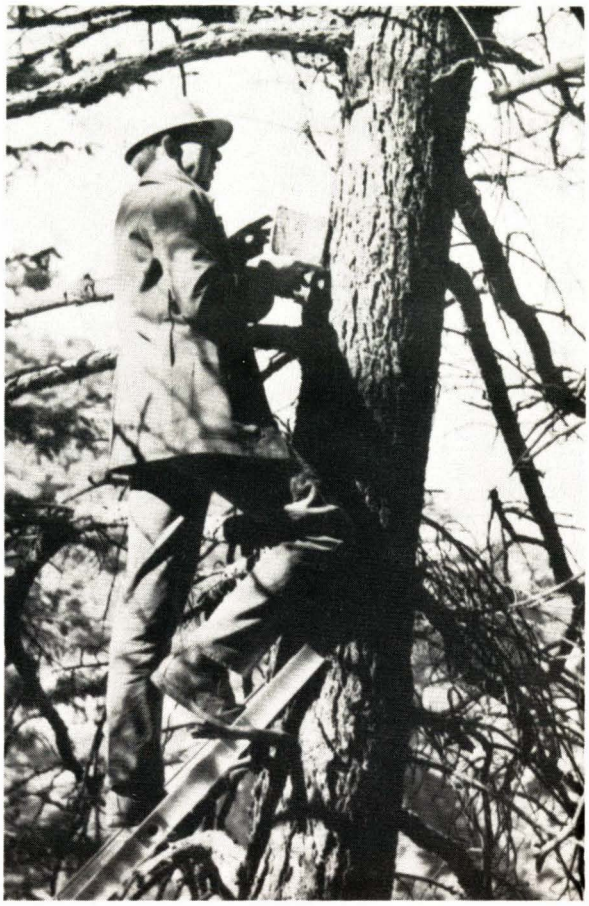
Canyon National Park. At Mesa Verde National Park, Cortez, Colo., the scale remains endemic in the 1962–1963 treated areas.

Southwestern pine top moth, *Rhyacionia* sp. Tip moths riddled leaders and lateral tips of 3- and 4-year-old ponderosa seedlings planted on the Sitgreaves National Forest near Winslow, Ariz. About 1,800 acres of pine plantations are immediately threatened, and 400 more acres ultimately threatened. Natural reproduction was not heavily damaged.

Tussock moths, *Hemerocampa* spp. and the pale tussock moth, *Halisidota tesselaris* (J.E. Smith). These tussock moths stripped 50 acres of alder and boxelder at Whitewater Campground and the Catwalk near Glenwood, N. M. This important southwestern recreational facility is annually visited by over 40,000 people. Control is planned in 1966.



F–513638
Injection of herbicides into newly attacked trees is being tested for control of bark beetles in the Southwest.



F–513639
Douglas-fir beetle infestations in the Southwest are evaluated by estimating bark beetle and parasite densities in bark samples taken 10 feet above the ground.

Seed and cone insects. Heavy populations of the ponderosa pine cone beetle, *Conophthorus scopulorum* Hopk., almost destroyed the already poor ponderosa pine cone crop on Sacramento Division of the Lincoln National Forest. Cones that escaped the beetle were hit by a pine seed chalcid, *Megastigmus albifrons* Wlk., that further reduced the meager cone crop. The spruce budworm, *Choristeneura*

fumiferana (Clem.), destroyed about 20% of the young Douglas-fir cones in an area south of Cloudcroft, N. M.

F–513637

The importance of the damage caused by cone and seed insects of Southwestern forest types is being investigated by research entomologists at New Mexico State University, Las Cruces, New Mexico.

The Douglas-fir cone moth, *Barbara colfaxiana* (Kearf.), infested an average of 34% of all Douglas-fir cones collected from four survey sites on the Lincoln National Forest. The fir seed moth, *Laspeyresia bracteatana* (Fern.), and the fir coneworm, *Dioryctria abietella* (D&S), infested 18% and 2% of the cones from these samples, respectively.

Urban-Forest insect. An eye gnat, *Hippelates impressus* Becker, was extremely annoying to urban residents and to recreationists using National Forest campgrounds near Albuquerque. This gnat is a known or suspected vector of various human and animal disease agents. This harrassment was the worst the species is known to have caused. The Forest Service helped the City Health Department obtain identification and related information from specialists at the University of California at Riverside. Also, a cursory examination was made of probable breeding sites in and near the affected area.

Other insects. The fir engraver, *Scolytus ventralis* LeC., continued to cause damage to white fir throughout the Region. Tree killing by the western balsam bark beetle, *Dryocoetes confusus* Sw., continued in stands of corkbark and alpine fir in New Mexico and northern Arizona. The California five-spined ips, *Ips confusus* (LeC.), killed groups of pinyon near Window Rock, Ariz. Several small infestation pockets of the Oregon pine ips, *Ips pini* (Say) (*I. oregonis* Eichh.), were reported throughout the Region. In untreated areas the grass plant bug, *Labops hesperius* Uhler, continues to reduce forage production of valuable rangelands.

LAKE AND CENTRAL STATES

By D. O. VANDENBURG, [1] Division of State and Private Forestry, Milwaukee, Wis.

Conditions in Brief

Defoliator activity increased throughout the forests of the Lake States. Infestations of the jack pine budworm extended over most of the major jack pine areas of Lower Michigan and portions of central and north central Minnesota. Scattered activity was also reported from Upper Michigan and Wisconsin.

The forest tent caterpillar became firmly entrenched in epidemic numbers in hardwoods along the northern border of Minnesota, and some defoliation also occurred on the Chippewa National Forest, and Menominee and Mackinac Counties, Mich. Red-headed pine sawfly populations seem to be increasing throughout the Lake States and damage was severe in some red pine plantations. For the

[1] Information compiled from reports submitted by Leo Abrahamsen, Minn. Dept of Agric.; Paul R. Flink, Mich. Dept. of Cons.; Ramon T. Gass, Mo. Dept. of Cons.; M. K. Idleman, Ohio Dept. of Natural Resources; Donald W. Renlund, Wis. Cons. Dept.; Donald L. Schuder, Purdue Univ., Ind.; R. G. Rennels, Univ. of Illinois; and Vaughan F. McCowan, Richard L. Fowler, Imants Millers, Steve O. Ryan, John O. Wernham, Arland Valcarce, Robert Doerner, all of U. S. Forest Serv.

third year, spruce budworm numbers declined in the spruce and fir stands of northeastern Minnesota.

Widespread infestations by the fall webworm throughout southern Missouri, Illinois, and Indiana caused much public concern due to the unsightliness of the webs and defoliation of roadside trees. Various pine defoliators and tip and shoot insects caused local concern in the Central States forests, but living tree borers of hardwoods remained the prime problem.

Major suppression activities in 1965 by public and private agencies were limited to field tests of promising non-persistent insecticides to suppress the forest tent caterpillar, pine tussock moth, and Saratoga spittlebug.

Status of Insects

Jack pine budworm, *Choristoneura pinus* Free. Epidemic populations continued to thrive throughout most of the jack pine areas in northern Lower Michigan. On the Huron National Forest the infestation is entering its fourth year but egg counts indicate a probable decline for 1966. However, on the Manistee National Forest an increase in populations and extensive defoliation is predicted.

In Minnesota this insect remained active on the Chippewa National Forest and the Red Lake Indian Reservation. However, no top-killing or tree mortality showed up. Heavy defoliation also developed in poorly stocked stands on the Beltrami Island State Forest, Brainerd-Bemidji area, and the St. Croix State Forest.

Low numbers were reported on the Wisconsin National Forests, but activity increased in widespread areas of State and private land in northwest Wisconsin.

The general population trend of this troublesome insect is up, especially in Michigan and Minnesota, although since the outbreak has persisted for several years on some areas, a population collapse is possible.

No operational suppression projects are scheduled for 1966. Testing of malathion LV^R concentrate and other non-persistent insecticides, however, has been proposed by the State of Wisconsin and the Huron-Manistee National Forest, Mich.

Forest tent caterpillar, *Malacosoma disstria* Hbn. This insect is at epidemic levels along the northern boundary of Minnesota. However, a great extension of heavy defoliation of aspen and other hardwood stands, predicted on the basis of an egg survey, did not take place in 1965, presumably due to spring climatic conditions unfavorable to larval development.

The Namakan-Crane Lakes area experienced light to moderate defoliation on about 250 square miles and heavy defoliation on almost 20 square miles. Activity increased on the Chippewa Forest, and in Menominee and Mackinac Counties in Upper Michigan. Defoliation in these latter areas is expected to increase.

In Michigan, 6000 acres of aspen were sprayed with short-lived insecticides to test their effectiveness against this insect. Some of the low volume applications show promise.

The Forest Service plans to spray some 1,000 acres with a natural control agent, a nuclear polyhedrosis virus, on the La Croix District, Superior Forest. It is hoped to reduce the buildup and decline cycle of the tent caterpillar from its normal 4–6 years to something less.

Spruce budworm, *Choristoneura fumiferana* (Clem.) For the third year budworm infestations of spruce and fir in northeastern Minnesota declined both in area and severity. Scattered tree mortality, however, still occurred along parts of the Echo Trail and near the Kawishiwi Experimental Forest. Although high larval populations persist in these areas, a general decline in numbers and size of egg clusters is reported.

Regeneration plots established on the Superior National Forest in areas of heavy tree mortality show full seedling stocking of balsam fir. Another budworm cycle can be expected when these trees become old enough.

Because resource values are low and adverse effects are rated as not critical, no suppression is planned on Federal, State or private land.

Pine tussock moth, *Dasychira plagiata* (Wlk.). The infestation in Douglas County, Wis., which covered some 12,000 acres in the fall of 1964, was reduced by natural control agents to a few hundred acres by May of 1965.

The light defoliation predicted for part of the Chequamegon National Forest failed to materialize.

Saratoga spittlebug, *Aphrophora saratogensis* (Fitch). Numbers of this insect are low on the Chequamegon, Ottawa, Hiawatha, and Nicolet National Forests, and on non-Federal lands in Michigan and Wisconsin in its range. The one exception is moderate levels of activity on parts of the Huron-Manistee Forest.

Suppression with 1/2 lb. DDT applied by mistblower and airplane was effective on several red pine plantations in Wisconsin.

A successful pilot test applying 1 lb., 1/2 lb. malathion and 10 fluid ounces of malathion LV^R concentrate per acre was completed on the Huron-Manistee Forest. One pound/gal/acre and the LV^R concentrate gave best results. The latter's low cost may revolutionize spittlebug control in the Lake States.

Pine sawflies, *Neodiprion* and *Diprion* spp. In general, damage caused by the various pine sawflies in the Lake and Central States was moderate. Of greatest concern was a population upswing of the red-headed pine sawfly, *N. lecontei* (Fitch), throughout the Lake States. Roadside jack pine was again defoliated on non-Federal land in the sand plain north of the Twin Cities, the Mille Lacs Lake area and the Cut Foot Sioux District of the Chippewa Forest. Activity also increased on the Huron-Mainistee, Nicolet, Ottawa, and Hiawatha Forests.

A generally low population of the introduced pine sawfly, *D. similis* (Htg.), was found on non-Federal land in Minnesota where rates of parasitism varied from high to extremely low. The red pine sawfly, *N. nanulus* Schedl, is common throughout the Manistee Forest and in the Norway Beach area of the Chippewa Forest. Michigan populations of the European pine sawfly, *N. sertifer* (Geoff.), declined and only spotty damage occurred in Livingston and Washtenaw Counties. However, activity in Illinois and Ohio increased.

A two-pronged attack for control of *N. sertifer* is planned on Federal land in 1966; a nuclear polyhedrosis virus test on the Nicolet Forest, and a malathion LV^R concentrate test on the Hiawatha Forest. No suppression is planned except on non-Federal land in Michigan, where small areas will be sprayed if infestation rates exceed 20 percent.

White pine weevil, *Pissodes strobi* (Peck). Light to moderate damage to plantations of white, red and jack pine occurred throughout the Lake States. Populations appeared static except on non-Federal land in southern Lower Michigan where they declined. No major suppression of this insect is planned on either Federal or non-Federal lands.

Red pine cone beetle, *Conophthorus resinosae* Hopk. This insect continues to be a major threat to red pine seed production on the Chippewa, Huron-Manistee, Nicolet, and Chequamegon Forests. No seed is expected to be collected from seed production areas on the Huron-Manistee this year as a result of attacks by this and other seed and cone insects.

Spring or fall prescribed burning of seed production areas may help by destroying the hibernating adults. A study using this experimental method is planned by the Lake States Forest Experiment Station.

Carpenterworm, *Prionoxystus robiniae* (Peck). This insect, plus various cerambycids, particularly the red oak borer, *Romaleum rufulum* (Hald.), continues to cause log and lumber degrade in the hardwood stands of the Central States. Populations are static at high levels in trees of the red oak group in Missouri, Illinois, Indiana, and Ohio. Removal of brood trees through timber stand improvement and normal timber sales activities is continuing.

Ips (pine engraver), *Ips* spp. In general, damage from the various ips beetles has remained localized in pockets on the Nicolet, Manistee, and Hiawatha Forests, where recent thinning operations and drought seem the most likely causes of attack. Ips beetles asso-

ciated with annosus root rot are common throughout the thinned pine stands of Missouri, Illinois, Indiana, and Ohio, but have not spread to healthy pine.

Other insects. Damage to red pine from the European pine shoot moth, *Rhyacionia buoliana* (Schiff.), declined again on all classes of land ownership in Lower Michigan and Ohio. Larch sawfly, *Pristiphora erichsonii* (Htg.), continued in low numbers on the Chippewa, Superior, and Ottawa Forests and on non-Federal land in Michigan and Wisconsin. Defoliation in all areas was generally light. In Minnesota, moderate to heavy defoliation was reported from broad areas in the north central and northeastern sections.

The high populations of the pine tortoise scale, *Tuomeyella numismaticum* (P. & M.), and the black pine leaf scale, *Aspidiotus californicus* Coleman, that were found on the Cass Lake District of the Chippewa Forest in 1964 were reduced by the combined effects of parasites and predators.

An unknown buprestid, *Buprestidae*, was found by entomologists in Ontario, and in Crawford and Oscoda Counties, Mich. The larvae feed on the bark and wood surface of red and jack pine. They completely consume the bark in a roughly circular area about 1/2 inch in diameter and later bore into the wood. The feeding area is covered by a hemispherical mass of reddish pitch similar to that caused by the pitch mass borer and Zimmerman pine moth.

Damage from infestations of the fall webworm, *Hyphantria cunea* (Drury), in southern Missouri, Illinois, and Indiana was restricted to roadside trees and posed no particular treat to forests. Defoliation and the unsightliness of the webs, however, caused much public concern.

SOUTHERN AND SOUTHEASTERN STATES

By W. D. BUCHANAN, [1] Division of State and Private Forestry, Atlanta, Ga.

[1] Report compiled from information submitted by the Zone Leaders at Asheville, North Carolina; Macon, Georgia; Alexandria, Louisiana; and State Pest Control personnel.

Conditions in Brief

The southern pine beetle was epidemic in many portions of the Southern and Southeastern States, especially north central North Carolina, South Carolina, Tennessee, Alabama, Mississippi, Louisiana, and Texas. The highest concentration of infestations was on the Oak Ridge Atomic Energy Reservation, Tennessee, where 858 infested trees per thousand acres were found in October 1965.

The black turpentine beetle and *Ips* spp. are close competitors and often cooperators with southern pine beetle in killing trees. These beetles are widely distributed and in 1965 killed as many, if not more, trees than the southern pine beetle.

Several species of insects caused heavy losses to pine seed and cones in various seed-producing sites and seed orchards in all Southern and Southeastern States. Infestations were not fully evaluated but the seed and cone pests reduce the volume of seed needed to reforest cutover and reclaimed land.

The balsam woolly aphid killed thousands of fir trees in areas of old infestation in North Carolina; new sites of infestation were found on the Tennessee side of Roan Mountain, one of which is near a Fraser fir seed production site.

Pales and associated weevils were highly destructive to pine seedlings in areas in North Carolina that were cleared in the late summer and fall, and planted in the winter.

Defoliating insects were generally less serious than in 1964. Sawflies, however, damaged pine stands in parts of Arkanses and Florida.

Status of Insects

Southern pine beetle, *Dendroctonus frontalis* Zimm. The southern pine beetle was epidemic in large portions of the South and Southeast. Numbers were especially high in the Oak Ridge, Tenn., Atomic Energy Reservation, and continued high in the north central Piedmont of North Carolina and in the Andrew Pickens District of the Sumter National Forest in South Carolina. Later in the season new epidemics developed in east-

ern North Carolina, but the epidemic on the Francis Marion District of coastal South Carolina collapsed. Near Sulphur, La. the beetles were at epidemic levels in about 18 sections. Epidemics also developed late in the season in Alabama, Mississippi, and Texas.

Black turpentine beetle, *Dendroctonus terebrans* (Oliv.). In general, infestations of this beetle were associated with logging of pine. These were more or less localized, but some increase was noted in cutover stands in Arkansas, Louisiana, Mississippi, and Texas. Chemical sprays were applied to infested trees and stumps in some areas to avoid or reduce population increases and damage to residual trees.

Ips (pine engravers,), *Ips* spp. In general, Ips beetles, namely *I. grandicollis* (Eichh.), and *I. avulsus* (Eichh.), were intermingled with southern pine beetle and black turpentine beetle infestations in all States. In the aggregate, these beetles killed as many or more trees than the southern pine beetle. In Alabama, tree killing was serious in drought-stricken stands.

Cone and seed insects. Insects annually destroy much of the seed crop from select trees in seed orchards and seed production areas in the South and Southeast. Accordingly, high quality seed in amounts needed by land managers to reforest cutover and reclaimed land often is insufficient to meet the total demand. Coneworms and seedworms cause most of the losses, but other pests, including cone beetles, also are destructive. One or more species of *Dioryctria* and *Laspeyresia* destroyed most of the seeds on 1,162 acres of seed orchards and 2,835 acres of seed production areas in 1965. The white pine cone beetle, *Conophthorus coniperda* (Sz.), also caused severe loss of second-year white pine cones in parts of North Carolina. Control of cone and seed insects in seed orchards and seed production areas is being tried by spraying from helicopter or by use of sprinklers fixed on individual trees.

Balsam woolly aphid, *Chermes piceae* (Ratz.). The balsam woolly aphid continued as a major pest and killed many trees in stands of

F–513641

Fraser fir is readily killed by heavy stem attack of the balsam woolly aphid. Pisgah National Forest, North Carolina.

Fraser fir in North Carolina. Infestations spread to additional areas, and was found for the first time on the east side of Roan Mountain, Tenn. Spread is believed to occur by wind and by aphid crawlers clinging to birds, animals, and man. Chemical sprays, importation of aphid predators, and other means are being used to control the pest, but with limited success. To date, predators have shown little impact on the aphid population and the high cost of chemical sprays precludes their use except along roadsides and in recreational sites.

Pales weevil, *Hylobius pales* (Hbst.). The pales weevil and associated species killed many young pines in coastal plantations in North Carolina. The amount of damage caused was closely related to sites cleared of overstory pines in the late summer and fall, and planted during the winter. Control of the weevil proved difficult. Neither pre-dip-

ping of seedlings in insecticides before outplanting, nor aerial spraying of seedlings in plantations yielded satisfactory results. The weevil problem is of major concern to land managers because grass, weeds, and brush rapidly invade cleared lands, requiring reclearing if planting is delayed for a year.

Loblolly pine sawfly, *Neodiprion taedae linearis* (Ross). This sawfly caused heavy defoliation of pine in Calhoun and Union Counties, Arkansas. A related species, believed to be *N. merkeli* Ross, defoliated about 3,000 acres of slash pine in Taylor County, Fla.

F–513787

Large numbers of a chrysomelid or leaf beetle damaged stands of pine near Murphy, North Carolina.

Forest tent caterpillar, *Malacosoma disstria* Hbn. This hardwood defoliator stripped more than 13,000 acres of tupelo gum in Alabama. The acreage of infestation, however, was less than in 1964.

Leaf beetle, *Glyptoscelis pubescens* (F.). This leaf-feeding chrysomelid caused severe damage to stands of pine in and around Murphy, N.C. The trend of infestations is unknown, but, if they persist, they pose a threat to seed orchards and seed production areas in the vicinity.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.). This tip moth continued as a serious pest of young pines in nurseries and plantations in all of the Southern and Southeastern States. It also was a problem in many seed orchards. Control of the pest is proving difficult.

Smaller European elm bark beetle, *Scolytus multistriatus* (Marsh.). This insect, the major vector of Dutch elm disease, has become firmly established in most parts of Arkansas, Oklahoma, North Carolina, South Carolina, and Georgia.

NORTHEASTERN STATES

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Conditions in Brief

The defoliators continued to be the most troublesome of our forest insect pests. In northern Pennsylvania and northern New Jersey, the fall cankerworm was principally responsible for the heavy defoliation of over three-quarter million acres of hardwoods. Pennsylvania found it necessary to spray 105,000 acres to prevent serious damage to valuable northern hardwood stands.

Another serious defoliator problem was the oak leaf roller complex. Damage by this group was extensive in many oak stands in Connecticut, New Jersey, and Pennsylvania. Outbreaks of the hemlock looper in Maine and New Hampshire required suppressive measures to prevent mortality of its host

trees. Other defoliators such as the gypsy moth, forest tent caterpillar, pine sawflies, the yellow-poplar weevil, and the pine looper increased in scope and severity. On the other hand the spruce budworm population in Maine decreased for the second consecutive year.

Other insects of importance were the white-pine weevil, white-pine shoot borer, balsam woolly aphid, red pine scale, and two new oak defoliators. There was some reduction in southern pine beetle populations; however, a potential epidemic still exists.

Several pilot control tests were undertaken by Federal and State agencies to find suitable substitutes for the more persistent insecticides.

Status of Insects

Fall cankerworm, *Alsophila pometaria* (Harris). The fall cankerworm complex continued to cause heavy defoliation in 1965. In north central and northwestern Pennsylvania, approximately 500,000 acres were defoliated, much of which had also been defoliated in 1964. Included in this outbreak are approximately 50,000 acres of northern hardwoods on the Allegheny National Forest. In addition, over a quarter million acres of oak forests were defoliated in northern New Jersey.

The spring cankerworm, *Paleacrita vernata* (Peck), the fruit-tree leaf roller, *Archips argyrospilus* (Wkr.), and the oak leaf roller, *Croesia semipurpurana* (Kerf.), were also present in these outbreaks. Tree mortality was extensive and heavy due to repeated defoliation plus several years of drought. In Virginia about 200 acres of oaks on the George Washington National Forest and several hundred acres on the Jefferson National Forest were heavily defoliated. Egg surveys in early 1965, in south central New York, indicated a high potential for severe defoliation, but this did not occur. Abnormal egg deposition and low hatch were believed to be the reasons. Only light to moderate defoliation was observed.

Suppression against the fall cankerworm was undertaken by the State of Pennsylvania in 1965. DDT at the rate of one-half pound per acre was aerially applied to 105,000 acres of valuable northern hardwoods. Excellent control was achieved. Pilot tests totaling about 1,200 acres were conducted in Pennsylvania and in New Jersey using *Bacillus thuringiensis*. Another pilot test of about 1,000 acres was carried out in Pennsylvania with the insecticide Sevin. The purpose of these tests was to evaluate their effects on the fall cankerworm in northern hardwoods and in mixed oak forests. The final results of these tests are not presently available.

Of special interest was the report of a granulosis virus in the fall cankerworm populations in northern Pennsylvania. It is not known if this disease was responsible for the marked reduction in defoliation observed where the virus was recovered. These areas will be kept under close observation in 1966.

Spruce budworm, *Choristoneura fumiferana* (Clem.). In northern Maine, populations of the spruce budworm continued at a low level in 1965 for the second consecutive year. Surveys indicated only small localized areas of medium–high egg mass counts. None of the areas appeared to be critical with respect to tree injury and possible mortality. Control is not planned for 1966. A reduced ground egg mass survey with an increased aerial defoliation survey is planned.

Hemlock looper, *Lambdina athasaria athasaria* (Guenee). Early in 1965, a severe outbreak of this looper was discovered at the northern end of Lake Winnipesaukee, N. H. By that time, extensive tree mortality had already occurred. Adult moth and early larval surveys made in June and July indicated that serious defoliation could be expected again in 1965. Accordingly, and since this is an area of very high recreational use, especially around the lake shore and on the islands, a control program was carried out by the State of New Hampshire in cooperation with the U.S. Forest Service.

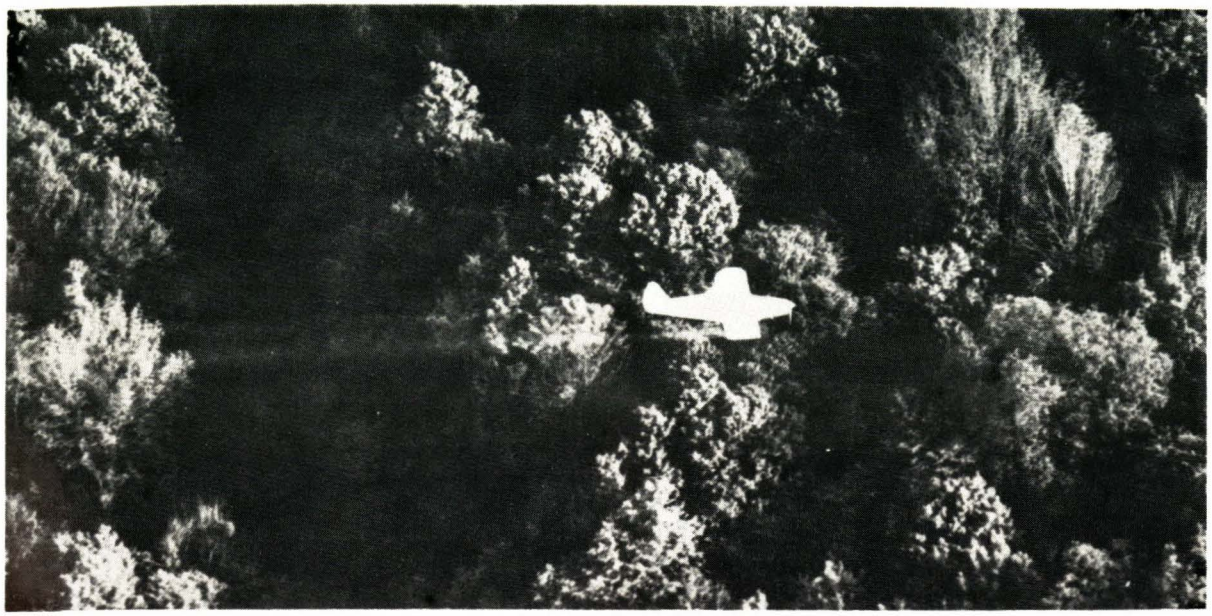
A helicopter application of low-volume malathion, at the rate of 10 oz. of technical malathion per acre, was made on August 17. Excellent control was obtained over most of the 600 acres treated. Some defoliation did recur

F-513948

Larval and frass drop trays were used to determine the effectiveness of *Bacillus thuringiensis* sprays for suppression of the fall cankerworm in Pennsylvania. (Photo courtesy of Pennsylvania Department of Forests and Waters).

on those hemlocks under heavy hardwood overstory. However, very few of the surviving larvae successfully pupated.

A small 25-acre looper infestation in Maine was successfully controlled with 1 pound of Dibrom per gallon of oil solution per acre applied June 22. Application was by fixed winged aircraft. The looper population was reduced by as much as 94 percent three days after treatment, with control reported as good on all crown levels, even under heavy hardwood cover. No adverse effects were reported from these control programs. A



F–513947

Aerial application of the microbial insecticide, *Bacillus thuringiensis*, was tested for control of the fall canker-worm in the northern hardwood stands of Pennsylvania. (Photo courtesy of Pennsylvania Department of Forest and Waters.)

small infestation near Rochester, N. H., and two in northwestern Pennsylvania caused moderate to heavy defoliation. Some tree mortality was reported in Pennsylvania.

An oak leaf roller, *Croesia semipurpurana* (Kerf.). Repeated defoliation by this insect combined with the current drought has resulted in extensive mortality of oaks over hundreds of thousands of acres in western Connecticut, southwestern Massachusetts, New Jersey, and Pennsylvania.

In Pennsylvania alone, over one-half million acres were heavily defoliated in 1965, with mortality of red and scarlet oaks being as high as 20 percent in localized areas. In northern New Jersey over a quarter million acres were heavily defoliated, with the fruit tree roller and the fall and spring canker-worms also contributing to the condition, as mentioned earlier. In southwestern Maine, increased defoliation was reported from many localities, but in New York, populations were reported as on the decline. In Connecticut there was heavy predation by "blackbirds" of the larvae spinning down to pupate. What effect this factor will have on the 1966 population is not known.

A 350-acre area in New Jersey was sprayed with one pound of Sevin per acre applied by helicopter. This the 15th consecutive year this area has been protected from insect defoliation. It now supports oaks in a healthy condition, while a nearby unprotected stand shows tree mortality averaging 12 1/2 percent with the remaining trees on the decline. Localized suppression programs may be required in Pennsylvania and New Jersey in 1966.

Forest tent caterpillar, *Malacosoma disstria* Hbn. Populations of the forest tent caterpillar dropped sharply in Maine during 1965. The presence of diseased caterpillars would indicate that a pathogen may have been involved in this decline. Also, below freezing weather in May probably had an adverse affect on the early larvae. In Pennsylvania and Vermont caterpillar populations continued to increase.

Noticeable defoliation, in some places nearly 100 percent, was observed on about 10,000 acres in New York. Extensive defoliation can

be expected in 1966 unless natural factors intervene. Light to medium populations were reported from scattered locations throughout New Jersey and eastern West Virginia. Diseased larval colonies were also observed in some of these infestations. No control programs are planned for 1966.

Larch sawfly, *Pristiphora erichsonii* (Htg.). Severe defoliation by this sawfly was reported from Maine, New York, and Pennsylvania. In Maine 185 acres of larch in the Acadia National Park were treated with malathion to control this pest. Two aerial applications (July 7 and July 27) were made, each of 1/2 pound of malathion in 1 gallon of oil per acre. Excellent control was reported. The two applications were considered necessary because of the prolonged adult emergence. This was a cooperative spray program between the Maine Forest Service and the National Park Service.

In central Pennsylvania many defoliated larch plantations failed to refoliate and dead tops were evident in a number of stands. Of special concern in the Pennsylvania infestations was the development of natural resistance in the sawfly to its principal parasite, *Mesoleius tenthredinis* Morley. Nearly one-half of the sawfly larvae parasitized by this parasite were able to encapsulate the parasite eggs thus preventing hatching. In West Virginia the small, light infestation on the Monongahela National Forest persisted, but was successfully treated with malathion to prevent noticeable defoliation.

Gypsy moth, *Porthetria dispar* (L.). The Agricultural Research Service, USDA, reported that approximately 263,201 acres of various species, particularly oak, were defoliated by this insect in the Northeast in 1965. Increased defoliation in 1966 is predicted for Connecticut, Rhode Island, New Jersey, and Pennsylvania, while a decline in populations is expected in Maine, New Hampshire, and Vermont. Continuing defoliation is expected in some parts of New York.

The reduction of gypsy moth populations in Vermont was believed mainly due to a polyhedral virus. Chemical control programs were carried out in Massachusetts, New York, New Jersey, and Pennsylvania. Sevin was used on Cape Cod, Mass., and in New York, New Jersey, and Pennsylvania. A pilot test with *Bacillus thuringiensis* was carried out in New York by the State in cooperation with the Northeastern Forest Experiment Station. Results of this test are not available at this time. Control programs in 1966 may be expected in some areas in New York, northern New Jersey, and eastern Pennsylvania.

European pine sawfly, *Neodiprion sertifier* (Geoff.). Defoliation by this sawfly increased in northern New Jersey from light in 1964 to generally moderate in 1965. Several infested red pine and Scotch pine plantations were treated with the polyhedral virus with excellent results. Scotch, red, and Austrian pines were heavily defoliated by the sawfly in eastern and western Pennsylvania, indicating that some localized control measures may be necessary in 1966.

Jack-pine budworm, *Choristoneura pinus* Free. The jack-pine budworm was observed for the first time in New York. Light populations occurred in several jack pine plantations in the south central part of the State. This could be a potential hazard to the extensive plantings of jack pine in this region.

Pine looper, *Lambdina athasaria pellucidaria* (G.&R.). A buildup of the pine looper on pitch pine was reported on Cape Cod, Mass. A previous infestation in this area collapsed 2 years ago and present populations are very light, even though moth flights were reported as heavy. There was no noticeable defoliation and late instar larvae were difficult to find.

A looper, *Phigalia titea* (Cram.). Defoliation of oaks and hickories by this looper continued in 1965 over a larger area in northwestern Virginia, but was not so severe as in 1964. It is expected that this infestation will continue through 1966.

Red-headed pine sawfly, *Neodiprion lecontei* (Fitch). Light to moderate populations were reported from Vermont, northern New York, and Pennsylvania. In southwestern Virginia, defoliation in shortleaf pine plantations was light and scattered, while population decline was noted in isolated stands of red pine on the Monogahela National Forest in West

Virginia. Control measures were conducted by the State of New York on 400 acres.

Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar). Infestations of this sawfly in Virginia continue to decline, with areas of light to moderate defoliation sparse and scattered. In northeastern Kentucky, chiefly on the Cumberland National Forest, considerable acreage of shortleaf, Virginia, and pitch pines was defoliated. Suppression may be necessary on several National Forest recreation areas.

A weevil, *Odontopus calceatus* Say. During 1965, yellow-poplar suffered severe browning throughout southwestern Virginia, southern West Virginia, eastern Kentucky, eastern Tennessee, and southern Ohio. This browning was caused primarily by leaf mining by the larva of this weevil. Such injury has become more widespread during the past several years.

An oak sawfly, *Pamphilius* sp. This pamphilid sawfly was first found in 1964 on red oak in southwestern Pennsylvania, and apparently it is a new North American species. In 1964 larvae of this sawfly caused up to 100 percent defoliation over 1,200 acres, but in 1965 no defoliation was observed. Investigation revealed diapausing larvae were abundant in the forest soil and litter. Study of the insect is continuing. The outbreak is expected to resume in 1966.

An oak leaf miner (Species undetermined). This leaf miner has been active in the Androscoggin Valley, Me., over the past 2 years. This year infestations were found in the town of Whitefield in Lincoln County. Treatments of individual trees with Bidrin, applied to the ground around the base of some trees or as a painted band treatment on the bark surfaces and on large trees as injections, have given good control. No information is available as to rates of application. This leaf miner has been found in areas of general oak decline which has been noticeable since 1956. Taxonomists are describing this insect as a new species.

Miscellaneous defoliators. The European spruce sawfly, *Diprion hercyniae* (Htg.), is present in noticeable numbers over much of the spruce area in the Northeast, and especially abundant in central Maine, with light defoliation observed in some white spruce plantations in Vermont. Populations of the orange-striped oakworm, *Anisota senatoria* (J. E. Smith), after decreasing in 1964, increased in 1965 in eastern New Jersey, heavily defoliating thousands of acres of scarlet and white oak saplings. Scrub oak stands were less heavily infested. Bruce spanworm, *Operophtera bruceata* (Hulst), and the linden looper, *Erannis tiliaria* (Harr.), were present in low numbers in the fall cankerworm outbreaks in Pennsylvania and New Jersey.

Defoliation by the birch leaf miner, *Fenusa pusilla* (Lep.), was reported from Maine to New Jersey. In Maine both *Fenusa* and *Profenusa* spp. were present with the latter particularly heavy on paper birch in the Androscoggin Valley. In Vermont, high to medium populations of *Fenusa* were reported statewide. This sawfly defoliated 400 acres of gray birch in the northwestern corner of New Jersey plus many small stands in the northern half of the State. An increase of the birch skeletonizer, *Bucculatrix canadensisella* Chamb., was noted in northeastern Pennsylvania, where over 40 acres of black and yellow birches were completely defoliated.

Populations of the fall webworm, *Hyphantria cunea* (Drury), continued to decline throughout the southern part of the Region. In eastern Pennsylvania, defoliation by the chain-spotted geometer, *Cingilia catenaria* (Drury), continued to increase for the third consecutive year. Over 700 acres of pitch pine–scrub oak type were reported defoliated.

White-pine weevil, *Pissodes strobi* (Peck). White-pine weevil populations appeared to be on the increase in 1965 in Maine and northern New Hampshire, but no appreciable change in population levels have been noted elsewhere. Some suppression activities are planned for 1966. Guidelines have been developed for evaluating white pine plantations in the Northeast for weevil control. In addition, control demonstration areas are being established in those states where the guidelines are applicable.

Southern pine beetle, *Dendroctonus frontalis* Zimm. Except in a few counties in Virginia, the predicted epidemic of the southern pine

beetle did not materialize, probable because of reasonable though meager rainfall which occurred throughout the high hazard areas. However, the potential for a bark beetle buildup remains. In southeastern Maryland on the Eastern Shore, a general population decline was reported, probably also due to rainfall.

White-pine shoot borer, *Eucosma gloriola* (Perg.). This insect is usually discounted as a serious pest of white pine. However, an attack on the terminal leader can cause serious deformation and loss in height growth. Heavy populations of the borer are present in northern New York plantations, where in some rapid growing trees the leader has been damaged for about one-half its length. Adventitious buds then form around the base of the killed portion and cause forking, similar to white-pine weevil damage. Infestations are spreading in northern New Jersey, where in 1965 the insect was found in all white pine plantations examined for the white-pine weevil.

Red pine scale, *Matsucoccus resinosae* B. & G. The slow but continuing spread of the red pine scale was again evident in 1965, with infested red pines found for the first time in West Haven, Conn. This is the most easterly reported find of the scale to date. New York reports no marked change in scale distribution, but results of the 1965 survey are not fully known. Early in 1965 scale infested red pines were found again in northern New Jersey, in the same general area where the scale had been found previously. All infested pines were cut and destroyed before spring. This area will be kept under close observation.

Of special interest is the report from Connecticut that scale populations in some of the Stamford watershed plantations appear to be on the decline, and that the predaceous anthocorid, *Xenotracheliella inimica* D.&H., may have contributed to this decline. Trees that were heavily populated with scale now appear to be recovering. An intensive survey program to determine more accurately the periphery of the red pine scale infestation was planned for Connecticut, New York, and New Jersey early in 1966.

Balsam woolly aphid, *Chermes piceae* (Ratz.). Reports from Vermont indicate slowly increasing aphid populations south of Route 2 in the presently infested area, with some fir mortality. No noticeable change has been reported from other northern states. The aphid infestation in the Shenandoah National Park in Virginia shows no change. Here gouting is the primary type of injury.

Pine-leaf aphid, *Pineus pinifoliae* (Fitch). Indications are that this insect has split into two broods over its entire range in the northern part of the Region, with the 1965 brood heaviest in the spruce gall-forming stage. Last year's brood on pine caused little damage. Populations of adults settling on pine were light this year, and recovery of past heavily attacked stands is slow.

The beech scale-nectria complex, *Cryptococcus fagi* (Baer) and *Nectria coccinea* var. *faginata.* This scale insect and disease complex is regarded as being mainly responsible for the rapid and steady decline of beech throughout Maine, New Hampshire, and Vermont. Both Maine and Vermont report a general increase in scale populations with nectria present in numerous, scattered locations. New Hampshire also reported nectria fruiting, especially around the base of large beech. Salvage cuts and reduced diameter limit cuts are being practiced as a means of control.

Beech scales, some nectria, and bark beetles are causing heavy losses to mature beech in New York. Ulster, Sullivan, Otsego, Cortland, and Herkimer Counties are particularly heavily hit by the complex. The scale but not the *Nectria* is now present in Luzerne and Monroe Counties, Pa.

Miscellaneous insects. Populations of the Nantucket pine tip moth complex, *Rhyacionia frustrana* (Comst.) and *R. rigidana* (Fern.), continued at light to moderate damage levels over most of southern New Jersey, eastern Pennsylvania, Virginia, and West Virginia. Damage continues to be most evident on seedlings and saplings. In southeastern Pennsylvania, planted red pines are becoming noticeably malformed by the European pine

shoot moth, *Rhyacionia buoliana* (Schiff.). Suppression studies are being carried on in localized areas. The drought conditions in many areas have made many oaks susceptible to the two-lined chestnut borer, *Agrilus bilineatus* (Web.). However, most activity has been restricted to weakened or suppressed trees.

This years excellent white pine seed production was somewhat damaged by white-pine cone beetle, *Conophthorus coniperda* (Sz.), activity. Also present, but to a lesser degree, were species of *Laspeyresia* and *Eucosma*.

Control measures were required for the black turpentine beetle, *Dendroctonus terebans* (Oliv.), on the George Washington and Monongahela National Forests, primarily in seed production areas.

A buildup of *Ips* beetles was reported from various localities, especially New York and Massachusetts, where pole-size plantations of drought-stricken red pine were hardest hit.

An unknown small, woolly scale has been found in the cracks and crevices of young maple trees on the Green Mountain National Forest and in the vicinity of Pittsfield. Vt. Maple bark samples showing scale symptoms similar to those observed in Vermont were received from Truxton, N. Y., Maine also reports the insect. The relationship of this scale to the current maple problem has not been determined.

ALASKA

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Conditions in Brief

Forest insect conditions improved considerably over 1964. The serious outbreak of the black-headed budworm succumbed to natural control factors. The hemlock sawfly, down considerably from 1964, was still abundant in some localities. An insect tentatively identified as the hemlock looper caused severe defoliation of Sitka spruce in the Bradfield River area near Wrangell. With minor exception, bark beetles were extremely scarce. A leaf feeding beetle caused extensive defoliation of cottonwood in areas near Haines and Skagway, but other hardwood defoliators did not cause appreciable damage anywhere.

Status of Insects

Black-headed budworm, *Acleris variana* (Fern.). The black-headed budworm, in outbreak status in portions of southeast Alaska during the past three years, subsided in 1965. Although budworm eggs hatched successfully, young larvae were virtually eliminated, presumably by a cytoplasmic polyhedral virus, believed to have been brought about by stress during the unusually warm, dry summer months.

Pronounced browning of Sitka spruce caused by budworm feeding was noted from Haines and Skagway inland to the Canadian border. However, egg counts during the fall months there and in hemlock stands elsewhere in southeast Alaska were light, portending a reduced population and resultant light to moderate damage in 1966.

Hemlock sawfly, *Neodiprion tsugae* Midd. Heavy concentrations of sawflies occurred on Prince of Wales and Chichagof Islands; populations are expected to remain high at these locations in 1966. Elsewhere in southeast Alaska, populations were much reduced from 1964.

Unknown looper. A looper, tentatively identified as *Lambdina fiscellaria lugubrosa* (Hulst), caused severe defoliation of some 430 acres of Sitka spruce in the Bradfield Canal area of the Wrangell Ranger District, southeast Alaska. Light defoliation extended over a considerably larger area. A continuation of the infestation in 1966 is indicated.

Sitka spruce beetle, *Dendroctonus obesus* (Mann.). The rate of tree killing by the Sitka spruce beetle was minimal throughout all of Alaska.

Ips (pine engraver), *Ips* spp. The ips beetles continued at low levels everywhere.

Cedar bark beetle, *Phloeosinus squamosus* Blkm. Tree killing by this beetle was common in southeast Alaska. However, the level of infestations are below those of the past few years.

F-513943

Forest insect detection surveys in southeast Alaska are conducted by a crew traveling by boat and, to a limited extent, by float plane.

Cottonwood leaf beetle, *Chrysomela scripta* Fab. This cosmopolitan pest defoliated large numbers of black cottonwood trees near Haines and Skagway. Trends of infestations and possible needs for control were not determined.

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